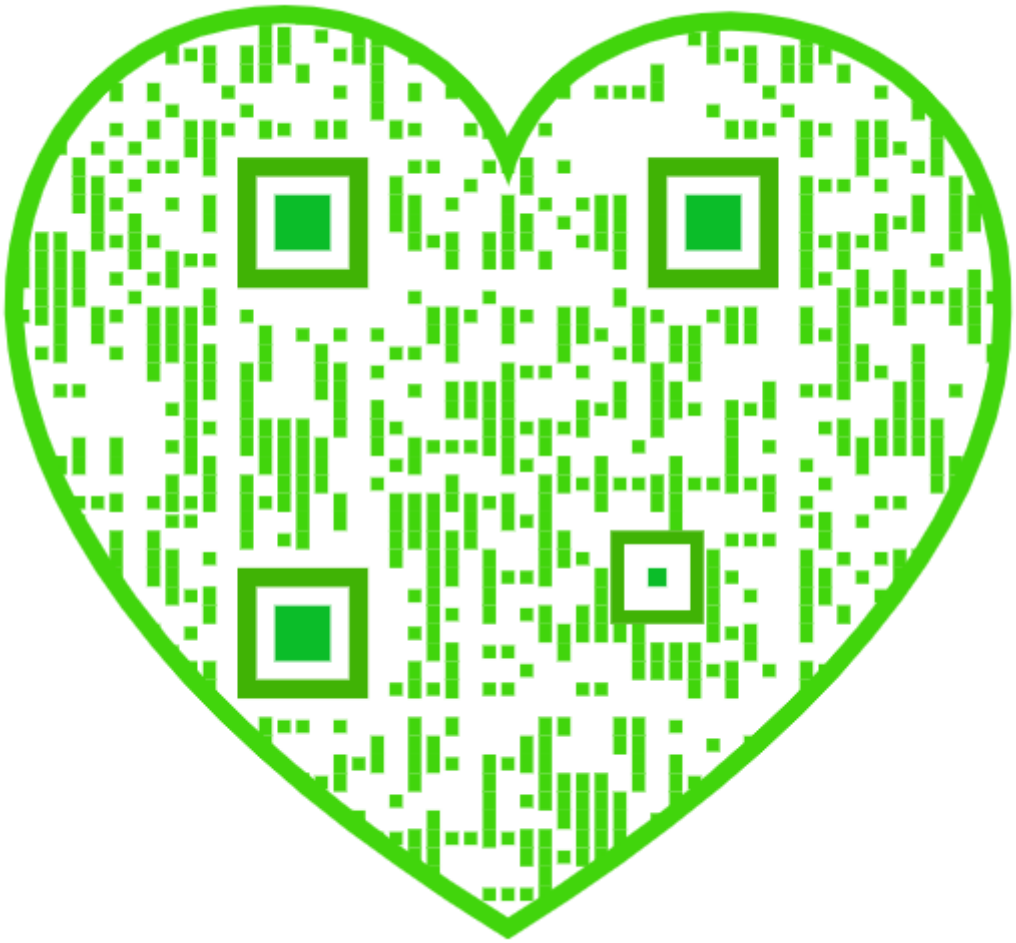

A COURSE IN

ELEMENTARY ARITHMETIC

ORAL AND WRITTEN

BY

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COURSE IN EL. ARITH.

W. P. I

PREFACE

It is quite generally admitted that the results obtained in the field of primary arithmetic are by no means commensurate with the attention which the subject receives in our schools. After several years of earnest effort, the pupils too often show little or no insight into number relations. Furthermore, the ability to handle numbers with accuracy and a fair degree of facility is also wanting. This lack of results, we believe, is due chiefly to the inadequacy of the methods commonly pursued in the teaching of this subject. It too frequently occurs that beginners are introduced to meaningless abstractions (which are retained only with difficulty, notwithstanding their frequent repetition), and are hurried on to the fundamental operations, which are rarely well mastered.

The work outlined in Chapter I of this book is designed to prepare the pupils for the intelligent mastery of the fundamental operations as presented in the succeeding chapters. Through the application of number to objects, an insight into number relations and the common operations is gained. Throughout this chapter the memorizing of facts is subordinate to the getting of ideas.

The mastery of the fundamental operations is taken up in the succeeding chapters, and a well-developed method is provided for each operation. The general plan of work is a simple one. The pupils are required to memorize a

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few number facts and to apply these until they have become perfect reflexes, before new facts are introduced. A constant review is provided, as the facts of previous lessons are involved in the drill exercises which follow the several lessons.

Simple work in fractions and denominate numbers is introduced in the first lessons, and continued throughout the book. A balance is maintained between the mechanical work on the one hand and the solution of problems on the other. The problems are of a practical character, and are drawn largely from the field of everyday experience. Whenever a problem of a given type seems to offer a language difficulty, several such problems are given in succession. Such repetition frequently occurs in the earlier pages of the text.

Frequent requests for detailed information with reference to the methods herein contained, and favorable reports from teachers and superintendents who have found these methods helpful in their work, have led to the preparation of this text, which, we trust, will be found of service in its field of intended usefulness.

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ELEMENTARY ARITHMETIC

CHAPTER I

PRELIMINARY LESSONS

TO THE TEACHER. The lessons of this chapter are designed to indicate the nature of the work that should be done by the class before the text is placed in the hands of the pupils. Space does not permit of the introduction of sufficient material to furnish all of the exercises which the pupils will need. The lessons in this chapter should, therefore, be regarded as type lessons which the teacher is to expand and to supplement to meet the needs of the class. It is not expected that all of the work suggested in any one of the lessons will be given at any one time. Several parallel lines of work are suggested in the various lessons, and these should be carried on together, the work gradually increasing in difficulty until the pupils have finally mastered all of the work indicated in each of the lessons.

No abstract number work, aside from counting and the reading and writing of numbers, is provided, and none should be given. The pupils should deal with number in its relation to things, and not with abstract number facts. In the exercises suggested in this chapter, the pupils themselves play an important part. They are required to *do*, as well as attend to what is done by others. They are led to discover number relations in the quantities that are

handled by them, and to express these relations in correct language.

These lessons are presented in the form of questions and directions given by the teachers, as serving best to illustrate the methods to be followed in presenting them to the class. No exercise should be continued so long that the pupils will begin to lose interest in it. The teacher is expected to use whatever objects may be at hand, and to vary the objects frequently. A box of 1-inch cubes will be found very useful in this as well as in subsequent number work. They are easily handled, and may be conveniently arranged to show relative quantities, etc.

The pupils should be encouraged to express themselves freely, but at the same time correctly. Sufficient time should be taken to acquaint the pupils with the language forms involved in these lessons. If properly presented, the work suggested in this chapter should not only give the pupils familiarity with simple number facts, and an insight into the common operations with number, but should also establish habits that will be found extremely valuable in all subsequent number work. Some of the number facts developed in these lessons are designated as facts to be learned. These should be perfectly memorized.

LESSON I — MAGNITUDE

The primary purpose of Lesson I is to train the pupils to hear and interpret simple directions. The secondary purpose is to acquaint the pupil with the language forms used to denote relative position, direction, magnitude, etc. After giving a direction, allow sufficient time for all the pupils to interpret the direction, and to image its execution. Should the pupil called upon fail to execute correctly the

direction given, do not call upon a second pupil for it, but give a new direction. This will be found more effective in keeping the attention of the whole class than the more common procedure, namely, that of permitting the brighter pupils to do most of the work. Later, return to the direction upon which a failure was made, and call upon some other child to carry it out, unless you have reason to think that the pupil who once failed can now execute it correctly.

Simple directions are to be executed, showing the meaning of the following and similar terms : *in your right hand, in your left hand, to the right of, to the left of, above, below, nearer, farther from, beside, between, in front of, larger than, taller than, tallest, shorter than, shortest, smallest, twice as long as, one half as long as, twice as far from, one half as far from, the same distance from, a line, at the end of, in the middle of, etc.*

ILLUSTRATION. Have two boys from the class, say John and James, stand *in line* in front of the class, John several feet to the right of James. *Problems:* 1. I want some one to stand *in line with* John and James. 2. Stand *in line with* the two boys, *to the right of* John. 3. Stand *in line, to the left of* James. 4. Stand *in line*, so John is *to your right* and James is *to your left.* 5. Stand *in line, the same distance from* the boys. 6. Stand *in line, nearer* John than James. 7. Stand *in line, farther from* James than from John. 8. Stand *in line, one half as far from* John as from James. 9. Stand *in line, to the right of John, one half as far from* John as from James. 10. Stand *out of line*, but the *same distance* from each of the two boys.

ILLUSTRATION. With colored crayon draw on the board lines of different lengths, for comparison. *Problems:* 1. Alice, tell me a story about the yellow line and the

blue line. *Story:* The yellow line is *longer than* the blue line. 2. Walter, tell me a story about the red line and the blue line. *Story:* The red line is *shorter than* the blue line. 3. Mary, tell me a story about the green line and the red line. *Story:* The green line is *as long as* the red line. 4. Who can tell me a story about the orange line and the blue line? *Story:* The orange line is *one half as long as* the blue line. 5. Who can tell me a story about the yellow line and the red line? *Story:* The yellow line is *two times* (*or twice*) *as long as* the red line. 6. Ethel, tell me a story about the red line, the blue line, and the yellow line. *Story:* The red line and the blue line together are as long as the yellow line.

Substitute lines drawn with white crayon and lettered *a*, *b*, *c*, etc., in place of the colored lines, and treat in a similar manner. Have the pupils point to the lines as they name them in giving their answers. Later, make written statements regarding these lines, leaving blanks for the pupils to fill in, thus: The red line is —— than the blue line. The —— line is shorter than the red line.

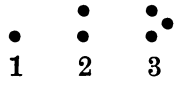
Compare the length of the board with its width, the height of the room with its width and length, etc.

LESSON II — COUNTING

In the preparation of this lesson, it is presumed that the pupils have acquired some number knowledge before entering school. The teacher should ascertain as soon as possible what knowledge the pupils have, and should adapt the lessons to the needs of the class.

ILLUSTRATION. *Problems:* 1. Harry, bring me one book from the table. 2. Jane, bring me two books. 3. How can I show on the board the number of books

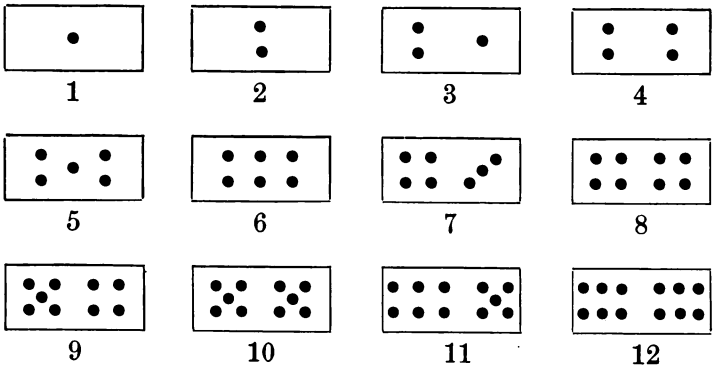
Jane brought me? 4. Fred, will you draw a line on the board for each book Jane brought me? 5. Walter, bring me three books. 6. Lottie, draw lines on the board to show how many books Walter brought me. 7. I will write on the board the figure that tells how many lines you made. 8. I can show the number of books Walter brought me in two ways: 1 1 1 books, and 3 books. 9. Count the books, one, two, three. 10. Alice may hold three books in her hand. 11. Mary may take two of the books that Alice has and place them on the desk. 12. How many books have you now, Alice? 13. Lottie, hold up one book. 14. Hold up two books. 15. Hold up three books. 16. I want some one to build a pile of three books and a pile of two books. 17. David, point to the pile of three books. 18. Emma, show me two girls. 19. George, stand three boys in line on the floor. 20. Send one of the boys to his seat. 21. How many boys are left standing? 22. I will show on the board the number of boys we have been talking about:



23. Mary, point to something that tells three. 24. Fred, point to something else that tells three.

Vary the objects counted, and continue the group pictures through twelve. The group pictures are used to represent the objects which the pupils have handled. Disks of colored paper mounted on cardboard may be used as flash cards for the recognition of these groups. The disks should represent any object whatever, and each disk represent whatever unit is selected. The group three may represent three boys or three apples, or it may

represent three ones, three nickels, or three tens. The groups through twelve may be arranged thus:



These groups should always represent concrete numbers, — apples, books, blocks, cents, dimes, etc.

Continue oral counting until the pupils are familiar with the number scale. Never ask a pupil to "count backwards." The attention of the pupils should be called to the place that a given number occupies in the number scale by such questions as the following: In counting, what number comes just before 20? What number comes next after 17? Twenty-seven comes before what number? From the exercises in counting and in the writing of the number table, the pupils should know what number is one more than any given number, and what number is one less than any given number.

Give exercises in counting by 2's to 12, using objects. Count by 2's the hands, feet, eyes, etc., of the pupils in the class. Count by 2's from 10 to 22. Count by 2's from 20 to 32, etc.

Count by 5's to 15, using objects. Count by 5's, using

nickels. Count by 5's from 10 to 25, from 20 to 35, etc. Count by 5's the minutes on the clock face.

Count by 10's to 110. Count by 10's from any given number, such as 1, 2, 5, 7, etc. to 110. Use the number table in connection with this work.

Before taking up the study of the text, the pupils should be able to count serially in any part of the number scale below 1000. They should be able to count by 2's, beginning with even numbers, and by 5's, beginning with numbers ending in 5 and 0, up to 100. They should be able to count by 10's to 110, beginning at any place in the first hundred of the number scale. They should know the number of tens there are in 30, 40, 80, etc. From a study of the number scale, they should know what one more than any number is, and what the sum of 10 and any number less than 10 is, what the sum of 20 and any number less than 10 is, what the sum of 30 and any number less than 10 is, etc. This knowledge is essential to the work in addition.

LESSON III — COMPARISON OF QUANTITIES

Using the inch cubes, have the pupils build "towers" with as many blocks as the figures on the table or the board specify, thus:

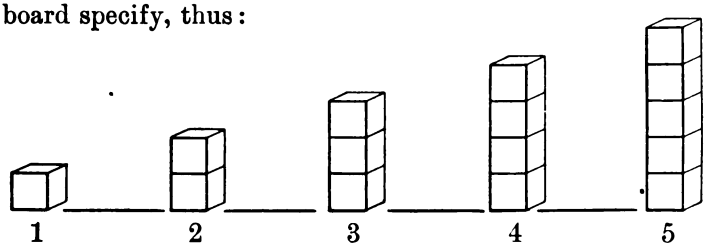
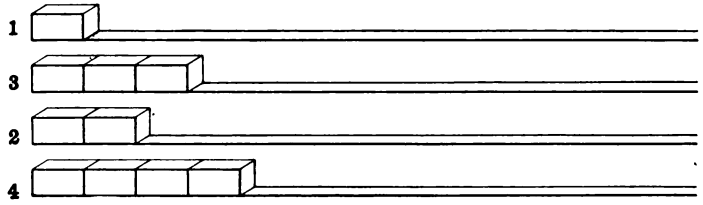


ILLUSTRATION. *Problems:* 1. Fred, tell me a story about the tower of 3 blocks and the tower of 2 blocks.

Story: The tower of 3 blocks is higher than the tower of 2 blocks. 2. How many towers of 2 blocks will it take to make a tower of 4 blocks? 3. What must you put with a tower of 5 blocks to make a tower of 7 blocks? 4. How many towers of 2 blocks can you make out of a tower of 6 blocks? 5. What must you do with a tower of 6 blocks to make a tower of 4 blocks? Of 5 blocks? Of 8 blocks? 6. Find a tower one half as high as a tower of 8 blocks.

Using blocks, build trains of as many cars as the figures on the tracks designate, thus:



1. How much longer is the train of 3 cars than the train of 2 cars? 2. What will you have to put with the train of 4 cars to make a train of 6 cars? 3. What will you have to do with a train of 5 cars to make it a train of 3 cars? 4. How many trains of two cars can you make out of a train of 8 cars? 5. How many trains of 3 cars must we put together to make a train of 6 cars? Of 9 cars? 6. Break the train of 10 cars into halves. How many cars are there in one half of it? How many are there in the other half of it? 7. Join a train of 2 cars to a train of 3 cars. It is as long as a train of — cars. 8. Join a train of 2 cars to a train of 6 cars. It is as long as a train of 4 cars and a train of — cars. 9. A train of 5 cars is — cars longer than a train of 3 cars.

LESSON IV — GROUPS

Separation into Groups. ILLUSTRATION. The teacher places 3 books on the table. *Problems:* 1. Harry, here are some books on the table. Take up some of them in your right hand, and the rest in your left hand. 2. How many books has Harry in his left hand? 3. How many has he in his right hand? 4. Name the number in each hand as he holds them up. 5. Count them as he puts them together. 6. Show on the board the number of books Harry holds in his right hand. 7. Show the number he holds in his left hand. 8. Harry, place the books on the table. 9. Annie, divide them into two groups.

ILLUSTRATION. *Problems:* 1. Fred, place 4 books on the table. 2. Separate them into two equal piles. 3. Mary, hold up one half of the books. 4. Has she the correct number? 5. How many books is Mary holding up? 6. How many groups of two books are on the desk? 7. How many groups of two books is Mary holding? 8. Mary, hold the other group of two books in your left hand. 9. How many groups of two books is Mary holding? 10. How many groups of two books is she holding in each hand? 11. Mary, place the books together. How many books have you altogether? 12. Separate the groups of two books. 13. How many groups of two books are there in four books? 14. Place the books on the desk in twos. 15. Willie, hold up one half of the books. 16. How many books is Willie holding up? 17. Hold up all of the books. 18. Place two of the books on the table. Two books are one half of how many books?

ILLUSTRATION. *Problems:* 1. Place four books in a pile. 2. Remove the books, one book at a time. 3. Remove the books, one 2-book group at a time. 4. Remove

the books, one book and a 3-book group at a time. 5. Remove the books, one 3-book group and one book at a time. 6. Count the books back, one book (placing down the one book), four books (placing down the 3-book group); two books (placing down the 2-book group), four books (placing down the other 2-book group), etc. 7. Close your eyes. Count the books by ones as you hear them touch the table. 8. Close your eyes. Count the books by twos as you hear them touch the table. 9. Close your eyes and count them as you hear the 3-book group, then the one book touch the table. 10. Close your eyes. Count them as you hear the one book, then the 3-book group touch the table. 11. Close your eyes. I have 4 books in my hands. In one hand I have 2 books. In the other I have — books.

Grouping. ILLUSTRATION. The teacher shows two books in her right hand and one book in her left hand. She brings the two groups together to form a single group. *Problems:* 1. I want some one to show on the board, with lines or figures, the number of books I hold in my right hand. 2. Mabel may show the number I hold in my left hand. 3. Martha may show the number I hold in both hands. 4. Close your eyes. Think of how the books looked which I held in my hands. When I say "up," I am going to hold up the books which I have in my right hand. 5. Up. Fred, you may tell me, without looking, how many books I am holding up. Think of how the books in my hands looked as I put them together. 6. I am going to bring them together. When you hear them touch, tell me how many books there are in the group. Using two objects and two objects, three objects and one object, etc., continue this lesson to twelve as a sum. Do not aim to have the pupils memorize the answers.

LESSON V — WRITING NUMBERS

Figures. The teacher should exercise much care in the making of figures, particularly those given as models to the class. They should be free from all unnecessary loops, and should all be of the same height, that proper alignment may be had in writing columns of figures. The pupils should be taught how to make their figures properly, and to write the numbers in a horizontal or a vertical line, preferably the latter. The arrangement shown in the number table will be found helpful.

NUMBER TABLE

1	11	21	31	41	51	61	71	81	91
2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
8	18	28	38	48	58	68	78	88	98
9	19	29	39	49	59	69	79	89	99
10	20	30	40	50	60	70	80	90	100

Writing Numbers. ILLUSTRATION. *Problems:* 1. Show with your counters two ones (1 1); three ones (1 1 1); four ones (1 1 1 1); ten ones (1 1 1 1 1 1 1 1 1 1). 2. Show with your counters one ten. 3. Show one ten and two ones. 4. Begin with 1 and write in a column the figures that stand for the numbers through 10. 5. In the number 10, which figure stands for no ones? This figure is read naught (cipher, or zero). 6. The ones' place is the first or right-hand place. What is the greatest number

that can be written in units' or ones' place? 7. The next place to the left is called tens' place. It tells the number of tens. 8. The units' place tells the number of ones. 9. In 10 which figure tells how many tens there are? 10. What does the naught tell? 11. Show with your counters 12, using your bundle of ten. 12. Show with your counters another ten. 13. Write in a column to the right of the first column the numbers in the second ten. 14. Show with your counters two tens and two ones. 15. Show with your counters 27. Continue this work until the number scale has been developed to 100. The tens in the number table are arranged to correspond to the tens in the number scale. The pupils should know that two tens are 20, three tens are 30, etc.

The number table should be used as the basis of counting by tens. Give much drill in reading and writing numbers to 120. Read 101 *one hundred one*, and not one hundred and one. Give many problems like the following: 1. If 121 is read one hundred twenty-one, how do you read 122? 126? 128? 2. How do you write one hundred twenty-five? 3. Change one figure in 125 and make it read one hundred thirty-five. 4. In 234 what does the 2 tell? What does the 3 tell? What does the 4 tell? 5. How many hundreds are there in one thousand? 6. Count by 100's to one thousand. 7. One thousand is written thus: 1,000. 8. Two thousand is written thus: 2,000. 9. We write one thousand two hundred thirty-four thus: 1,234. 10. For our convenience in reading the numbers we shall always separate the part of the number that tells the thousands from the part of the number to the right of it. 11. How many places are there to the right of the comma in 1,234? 12. There must always be three places to the right of the comma. 13. These three

places constitute the first period, or ones' period. 14. How many ones are there in 234? Read 234 *two hundred thirty-four*. Do not give the name of the period, which is ones'. 15. One thousand one is written 1,001.

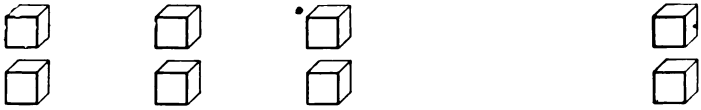
Give special attention to the reading and writing of numbers between 100 and 120, and between 1,000 and 1,100. It will be helpful at first to separate the periods by a vertical line instead of a comma, as it will emphasize the fact that each period must be taken separately. The number 350,406 consists of two parts, either of which can be read without much difficulty. The part at the left of the line (or comma) should be read without reference to the rest, and its name (thousands) given. The part at the right of the line (or comma) should be read as though it stood alone. At the close of this work the pupils should be able to read and write correctly numbers of two periods, without any hesitation.

Rapid Drill Exercises. With the class at the board, give frequent exercises in writing numbers. ILLUSTRATION. *Directions:* Hold the crayon in your right hand and the eraser in your left hand. Attend carefully to what is said, and do only what you are told to do. *Exercises:* Write 20. Change one figure and make it read 30. Change one figure and make it read 40; 50; 60; 90. Change one figure and make it read 19; 13; 15; 11; 71; 21; 91; 95. Erase one figure and make it read 5. Add one figure and make it read 65. Add another figure and make it read 465. Change one figure and make it read 405; 105; 175; etc. Write 25. Add one figure so as not to change the reading (025). Add one figure and make it read 1,025. The value of this exercise will depend largely upon the teacher's ability to conduct it with dispatch.

LESSON VI — DIVISION BY MEASUREMENT

Division by Measurement. The teacher should not confuse division by measurement with division by partition.

ILLUSTRATION. Place six counters or blocks in a pile near one end of the table. Near the other end place two similar counters, to be used as a measure in measuring this group. *Problems:* 1. Measure this pile of counters, using the measure which you see at this end of the table. Arrange your counters at the center of the table.



2. How many times did you use the measure? 3. How many two counters are there in six counters? 4. Mary may measure the same pile of counters, using the same measure. 5. Measure the same pile with three counters as a measure. 6. How many three counters are there in six counters? 7. Measure the same pile with one counter as a measure. 8. How many times one counter are there in six counters?

Continue this work until you have used one, two, three, four, five, and six counters as units of measure in measuring piles of not more than twelve objects.

Measure off a space, say six feet, on the board as the distance to be measured. Use the yard stick as the unit of measure. Use the foot rule as the unit of measure. Use also a 6-inch rule as a unit of measure. The purpose of this exercise is not to find the distance between the two

points, but to develop the idea of units of measure. *Problems:* 1. How many times did you apply the longest measure? 2. How many times did you apply the shortest measure? 3. How many times did you apply the other measure? 4. Which did you apply the greater number of times, the longest measure or the shortest measure?

Use the pint, quart, and gallon as units of measure.

Have the pupils find how many different units of measure can be applied to a pile of twelve counters; to a pile of eight, six, nine, seven, five, and eleven counters. Have them select the number of counters as high as twelve, that can be measured with two counters without a remainder. Associate this list with counting by 2's. Even and odd numbers will be recognized by this test, and the pupil should become familiar with them through this experience.

Use the flash cards for recognition of units. The group for five is two 2's and 1, five 1's, or one 5; the group for six is two 3's, three 2's, six 1's, one 6, one 4 and one 2. The pupil may not be able on account of the arrangement of disks to see the group 5 and 1. No attempt should be made to have the pupils memorize these facts.

LESSON VII — INCHES, FEET, AND YARDS

Foot and Yard. ILLUSTRATION. Draw on the board two vertical lines nine feet apart, or such distance apart as can be measured with the foot rule and the yard stick without a remainder. Letter the lines *a* and *b*. *Problems:* 1. How far is it from line *a* to line *b*, Frank? 2. How far do you think it is, Henry? 3. Alice, how can we find out how far it is? 4. Shall I measure it with a string? 5. Tell me of some measure I can use to measure it.

6. Does any one know of any other measure that can be used? 7. Fred and Walter may measure it with the yard stick. Martha may write their answer on the board. 8. Are they measuring it correctly, class? 9. Henry and John may measure it with the foot rule. Lottie may write their answer on the board. 10. With which measure do you think it is easier to measure it, Ethel? 11. Why? 12. Measure the yard stick with the foot rule. 13. How many foot rules could be made of a yard stick, Belle? 14. How many feet long is the yard stick? 15. How many feet are there in one yard? 16. Which is it better to use in measuring the length of the room, the foot rule or the yard stick? 17. Who can name something that is sold by the yard? 18. The foot rule is marked off into little spaces. 19. What are these called? 20. How many inches are marked on the foot rule? 21. How many are there on the yard stick? 22. What are inches for? 23. Why do we want so many different measures to tell length and distance? 24. Did you ever hear any one tell how far it is from your home to the school house? 25. Did he tell it in yards, inches, or feet?

Use the yard stick and the foot rule in measuring other distances in which there is no remainder. Measure the distance between two lines four feet apart with the yard stick. Measure the part remaining with the foot rule. Measure in the same way five feet, seven feet, ten feet, eleven feet, etc. Mark the feet on the yard stick. Measure three feet six inches with the yard stick, to show the pupils how the yard stick may be used to find the exact measure in inches, feet, and yards. Give practice in measuring yards, feet, and inches with the foot rule and the yard stick. Give practice in drawing lines one foot

long, two feet long, and one yard long. Test these by measuring. Give practice in estimating short distances. Test these estimates. Much interest will be aroused by measuring the height of the children. Lead the pupils to see the necessity of longer units of measure to measure greater distances. Mention the rod and the mile as such units. Upon the completion of this work, the pupils should know that there are twelve inches in one foot, and three feet in one yard. They should be able to draw lines to represent these measures with a fair degree of accuracy. They should be able to use these measures in finding the length of the room, the height of other children, etc.

LESSON VIII — PINTS, QUARTS, AND GALLONS

Use the pint, quart, and gallon measures in giving this lesson. The pupils should be led to see the necessity for measuring things that are bought and sold. They should also see the necessity for fixed units of measure, and for units of measure of various sizes. They should see that such indefinite units as half a basketful, half a sackful, half a pailful, etc., cannot be fixed units for buying and selling.

Before taking up this lesson the teacher should provide a definite quantity of water, say eleven pints. ILLUSTRATION. *Problems:* 1. Harry, how much water is there in this pail? 2. Alice, how much water do you think there is in this pail? 3. How much do you think there is, John? 4. How can we find out how much water there is in it? 5. What shall we measure it with? 6. Select one of the measures for this purpose. 7. This is called the pint measure. 8. Is there a pint of water in the pail? 9. Are there two pints of water in it? 10. How many

pints of water do you think there are in it, George? 11. Measure it. Mary may write the number of pints on the board. 12. Could we measure it in anything but pints? 13. Select the quart measure. 14. Do you think there is enough water to fill this measure? 15. How many quarts of water do you think there are in the pail? 16. Measure it in quarts. 17. Do you think there is enough water to fill this larger measure? 18. Will it fill it twice? 19. Who can tell what this large measure is called? 20. Measure it with the gallon measure. 21. Is there enough left over to fill the pint measure? 22. Is there enough left over to fill the quart measure? 23. Fill the quart measure. 24. Is there a pint of water left in the pail? 25. Fill the pint measure. There was one gallon, one quart, and one pint of water in the pail. 26. What is sold by the pint? By the quart? By the gallon?

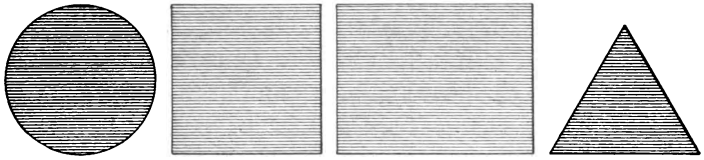
The pupils should become familiar with the names of the measures through hearing them used. They should learn the relative sizes of the measures by actual experience with them, by using one as a measure in filling the other, etc. The ratio of the several measures should also be perceived. A quart of water is twice as much as a pint of water. Its ratio to a pint is two. A pint of water is one half as much as a quart of water. Its ratio to a quart of water is one half. If this • stands for a pint of water, what will stand for a quart of water? If ⁘ stands for a quart of water, what will stand for a gallon of water? Use counters to represent the measures, so the pupils can handle them.

At the completion of the work suggested in this lesson the pupils should be familiar with the pint, the quart, and the gallon as units of liquid measure. They should know

that a quart equals two pints, that a gallon equals four quarts, that a gallon equals eight pints, that a pint equals one half of a quart, that a quart equals one fourth of a gallon.

LESSON IX — FORMS

Teach pupils to distinguish the following geometrical forms: the circle, the square, the oblong, and the triangle. To guard against the common error of associating these names with the lines which form the perimeters of these surfaces instead of with the surfaces themselves, attention should be directed to surfaces which stand out in contrast to surrounding areas. If the blackboard is used to show these forms, the surfaces should be shaded, thus:



Cut circles, squares, oblongs, and triangles out of cardboard, and have the pupils tell what the forms are. Have the pupils draw these forms on paper. These surfaces should be shaded.

Problems: 1. What is the shape of the window panes? 2. What is the shape of the door? 3. What is the shape of the blackboard? 4. What is the shape of the top of your desk? 5. What is the shape of this piece of paper? 6. What is the shape of this book? 7. What is the shape of the top of this table? 8. What is the shape of this picture? 9. Name something in the room that is a square. 10. Name something that is a triangle. 11. Name something that is a circle. 12. A square has

how many sides? 13. A triangle has how many sides? 14. The four sides of a square are of the same length. 15. Two sides of the oblong are longer than the other two sides. 16. A triangle has how many corners? 17. The square and the oblong have each how many corners? 18. Cut a square out of paper. 19. Fold it to make an oblong. 20. Fold it to make a triangle.

LESSON X — FRACTIONS

One Half. 1. To cut an apple in half, we cut it "through the middle." 2. There are two halves in one apple. 3. The halves are of the same size. 4. If I eat one half of an apple, how much of the apple will be left? 5. If I cut two apples in half, how many halves shall I have? 6. Draw an apple on the board. Using a crayon for a knife, cut it into halves. 7. Draw a pie, a loaf, an orange, etc., on the board and cut them in the same manner. 8. How many halves are there in an orange? A loaf? A pie? 9. How many halves are there in anything? 10. Draw a line on the board. Using a crayon, cut it into halves. 11. Which half is the longer? 12. Show where you would cut the ruler in order to cut it into halves. 13. Stand halfway from the desk to the door. 14. I have two apples. How can I give one half of them to Alice? 15. Draw two apples on the board and divide them thus: . 16. Show in the same way one half of a group of four apples, six apples, eight apples, ten apples, and twelve apples, using the arrangement of groups given on the flash cards. 17. What is one half of six apples? 18. Place eight boys in a line in front of the class. 19. Send one half of the boys to their seats. 20. Four boys are one half of how many boys? 21. Send one half of the remaining

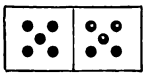
boys to their seats. 22. Two boys are one half of how many boys?

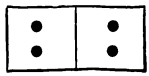
One Fourth. 1. Show one half of a circle. 2. Show one half of one of these halves. 3. Show one half of the other half of the circle. 4. The circle is now cut into four equal parts. 5. Each part is one fourth of a circle. 6. One fourth of a circle is the same as a quarter of a circle. 7. There are four quarters or fourths in a circle. 8. There are two fourths in one half of a circle. 9. In the same way show the fourths of a square; of an oblong; of a line. 10. If I cut a pie into fourths, and eat one of the fourths, how many fourths will be left? 11. Take twelve blocks and divide them into four equal groups. 12. How many blocks are one fourth of twelve blocks?

One Third. Treat in a similar manner the fraction one third. Use the foot rule and the yard stick in illustrating one third. Show one third of lines, circles, squares, and oblongs. By means of diagrams lead the pupils to see that one third of a circle is less than one half of a circle. Using six objects, show what is meant by one half of six; and with six similar objects show what is meant by one third of six. Show also what is meant by two thirds of six.

Draw figures to illustrate one fourth, three fourths, one third, two thirds, etc., using squares, circles, lines, and oblongs, and have the pupils recognize the fraction by the shaded areas. With objects have pupils find one half, one fourth, and one third of numbers through twelve.

Using the groups on the flash cards, have the pupils show one half of ten oranges; one half of four apples, thus:





Require exact statements with reference to these fractional parts.

At the completion of this work the pupils should have a very clear conception of what is meant by one half, one third, and one fourth. They should be able to show this by means of simple drawings. They should also be able to show what is meant by one half of six apples, etc. They should have memorized some of the simple facts, such as: two apples are one half of four apples; three boys are one half of six boys; one half of eight blocks is four blocks; etc.

LESSON XI — DIFFERENCE

The purpose of this lesson is to lead the pupils to measure the excess of one quantity over another quantity, and to acquaint them with the language forms used to express this difference. A new operation is involved in this, namely, subtraction. ILLUSTRATION. *Problems:* 1. Harry, Walter, and Ethel may stand in line in front of the class. 2. How many children are standing in line, Edna? 3. How many girls are standing in line, Fred? 4. How many boys are standing in line, Mary? 5. Of which are there more, girls or boys? 6. How can I make the number of boys and girls the same? 7. Who can tell me another way of making the number of girls and boys the same? (The teacher should lead the pupils to see that the number of boys and girls may be made the same, (*a*) by sending one of the boys to his seat, or (*b*) by having another girl stand in line.) 8. There are now two boys and two girls standing in line. If I place another girl in the line, how many girls will there be then? 9. Rose may stand in line with the others. There are now two boys and

three girls standing in line. 10. How many more girls are there than boys? *Answer:* There is one more girl than boys. 11. Show this by taking away one girl. 12. Return the girl to her place. Show the same by adding one boy.

Measure differences between the number of blocks in two groups.

Draw on the board two circles to represent two plates. One of them is the teacher's, and the other the pupil's. Place three oranges on one plate, and one on the other plate. Lead the pupils to see how many more oranges there are on one plate than on the other. The number that must be added to the smaller quantity or taken from the larger quantity, in order to make both quantities the same, is the measure of difference. The pupils should be able to get this difference by both methods. Make no attempt to have the pupils memorize these results.

LESSON XII — NUMBER STORIES

ILLUSTRATION. *Problems:* 1. Harry, take five blocks out of the box and put them on the table. 2. Mary, tell what Harry did. *Story:* Harry took five blocks out of the box and placed them on the table. 3. Grace, you may take away two of the blocks that are on the table. 4. Fred may tell us a story about what he saw. *Story:* There were five blocks on the table. Grace took two of the blocks away. There are three blocks left on the table. 5. Walter may take two of the blocks away. 6. Martha, tell a story about what you saw. *Story:* There were three blocks on the table. Walter took two of the blocks away. There is one block left on the table. 7. George may take one block away. 8. Lottie, tell a story about what you saw. *Story:* There was one block on the table.

George took it away. There are no blocks left on the table. 9. Alice may place three blocks on the table. 10. Fred may tell what he saw. *Story:* There were no blocks on the table. Alice placed three blocks on the table. There are three blocks on the table. 11. Jane may place two more blocks on the table. 12. Richard may tell a story about what he saw. *Story:* There were three blocks on the table. Jane placed two more blocks on the table. There are now five blocks on the table. 13. Ruth may place one more block on the table. 14. Jessie may tell a story about what she saw. *Story:* There were five blocks on the table. Ruth placed one more block on the table. There are now six blocks on the table. 15. We shall call the blocks apples, and the table a tree. Mary may tell us how many apples are on the tree. 16. Willie may pick two of the apples. 17. Frank, tell a story about what Willie did. *Story:* There were six apples on a tree. Willie picked two of them. There are four apples left on the tree. 18. Who wants to pick two more apples off the tree? Vera may do so. 19. Edna may tell a story about what was done. 20. James may pick one half of the apples that are left. 21. Mary may tell what she saw. 22. Fred may pick the rest of the apples.

We shall pretend that these two blocks are birds, and the table a fence. 1. Willie, tell a story about what you see. *Story:* I see two birds sitting on a fence. 2. Frank, show two more birds coming to the fence. 3. Grace, tell the story about these birds. *Story:* There were two birds sitting on a fence. Two more birds came to the fence. There are four birds on the fence. 4. Lucy may make two of the birds fly away. 5. David may tell a story about the birds. *Story:* There were four birds on a fence. Two

birds flew away. There are two birds left on the fence. 6. Edna may bring three more birds to the fence. 7. Walter may tell the story. *Story:* There were two birds on a fence. Three more birds flew to the fence. There are five birds on the fence. 8. We can tell this story on the board in this way:

$$\begin{array}{r} 2 \text{ birds} \\ +\ 3 \text{ birds.} \\ \hline 5 \text{ birds} \end{array}$$

The mark + means more. It means that three more birds came to the fence. 9. Looking at the board, Fred may tell us the story again. 10. Now there are five birds on the fence. Willie may help two of the birds to fly away. 11. Grace may tell the story about the birds. 12. We can tell this story on the board in this way:

$$\begin{array}{r} 5 \text{ birds} \\ -\ 2 \text{ birds.} \\ \hline 3 \text{ birds} \end{array}$$

13. Looking at the board, Mary may tell the story again. 14. The mark − means less. It means that there were two less birds on the fence after the two birds flew away. 15. I am going to write a different story on the board, and I want to see who can tell it.

$$\begin{array}{r} 2 \text{ birds} \\ +\ 4 \text{ birds.} \\ \hline 6 \text{ birds} \end{array}$$

Story: There were two birds on a fence. Four more birds came to the fence. There were then six birds on the fence. 16. Who can give the story that this tells?

$$\begin{array}{r} 4 \text{ birds} \\ -\ 3 \text{ birds.} \\ \hline 1 \text{ bird} \end{array}$$

Story: There were four birds on a fence. Three of the birds flew away. There was one bird left on the fence. 17. Who can give the story that this tells?

$$\begin{array}{r} 2 \text{ boys} \\ +\ 2 \text{ boys.} \\ \hline 4 \text{ boys} \end{array}$$

This lesson, like all other

lessons in this chapter, should be expanded by the teacher. Objects should be used to illustrate all of the problems given under this lesson, and the groups should not exceed six objects. The operation involved in each problem is thus made evident to the pupils. They should be made familiar with the language forms associated with these operations. They should also learn to express the operations in such written forms as are given in Problems 8 and 12. Given the written forms, they should be able to make number stories (problems) from them. They should be able to illustrate these by means of objects. No attempt should be made to have the pupils memorize the results in any of the problems.

LESSON XIII — MEASURE OF TIME

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
12 months (mo.) = 1 year.

Teach the names of the days of the week. Use these names in written work.

Teach the names of the months, their abbreviations, and the number of days in each. The number of days in each month should be taught without the use of rhyme.

The pupils should be able to tell which is the sixth month, the third month, what month July is, October is, etc., without naming the months from the beginning of the year.

Pupils should be able to tell the time of day, and to estimate without the use of a timepiece the length of seconds and minutes.

SUMMARY OF CHAPTER I

The work outlined in Chapter I should be completed before the book is placed in the hands of the pupils. Upon the completion of this work the pupils should be able:

1. To count serially in any part of the number scale below 1,000; to tell from the study of the number scale what one more than any number is, and what one less than any number is; to tell the number of tens there are in 20, 30, etc.; to tell what the sum is when any number less than ten is added to 10, 20, etc.; to count by tens to 110, beginning with any of the first ten numbers in the scale; to count by fives to 110, beginning with 5, and by twos to 50, beginning with 2.

2. To read and write numbers of two periods readily; to tell the place value of figures in numbers less than 1,000.

3. To measure short distances in inches, feet, and yards; to draw lines to represent these units of measure with a fair degree of accuracy; to estimate lengths of less than two feet in inches, of less than ten feet in feet, and of less than five yards in yards; to compare the length of the inch, foot, and yard; to use the pint, the quart, and the gallon measures in measuring liquids; to give the number of pints there are in a quart, and the number of quarts there are in a gallon.

4. To recognize the circle, the square, and the oblong.

5. To show what is meant by one half, one third, and one fourth; to find these fractional parts of small groups of objects.

6. To measure groups of objects using given units of measure.

7. To solve simple problems objectively, and to express the solution correctly in both the oral and the written form.

CHAPTER II

GENERAL INTRODUCTION

ADDITION

Step A. Five addition combinations are made to constitute a lesson in addition. These should be perfectly memorized. Sufficient drill should be given to make them perfect reflexes. Following each new set of combinations, on the same page are a number of oral problems, in solving which the pupils may refer, if necessary, to the combinations at the top of the page. Many similar problems, involving the same combinations, should be given by the teacher, and the pupils should be encouraged to make simple problems involving the combinations of each lesson. These should deal with things within the experience of the pupils.

After the pupils have memorized the combinations of a lesson, as given with answers in the text, they should take up the study of the lesson as arranged without answers on the succeeding page. This study should be pursued as indicated on pp. 48, 49. The combinations should be written on the board, and the pupils should be given a rapid and thorough drill upon them. The order in which they are arranged on the board should vary, and the pupils should not depend for their knowledge of the combinations upon any sequence in the drill exercises.

The pointer should always rest upon the upper number of the combination, as the pupils will commence at the

foot of the columns to add. The pupils should give the sums without naming the numbers in the combinations. In speaking of a combination, the lower number should be named first. The combinations of Lesson A are 2 and 3, 5 and 4, etc. The lesson should be thoroughly mastered through Step A before the pupils undertake to study it as directed in Step B.

Step B. After the combinations of a lesson have been memorized and have been used in simple problems, a study exercise is provided. The teacher should see that these exercises are diligently and correctly studied as explained on pp. 48, 49. The teacher should study the lessons with the pupils until they are able to continue without assistance.

The purpose of this study exercise is to prepare the pupils for column addition. Nowhere in column addition, except in the first combination added, will the combinations occur as they were memorized in Step A. In the addition of the column, the combination is no longer 2 and 3, but is, instead, 12 and 3, 22 and 3, etc. At each step in the addition of a column, after the first sum has been obtained, the lower number is retained mentally. For this reason, in studying the lessons through Step B, the pupil is required to retain mentally the tens of the lower number in each combination. Oral and written exercises in which the lower number is increased by 10, 20, 30, etc., to 100, may supplement this study, but should not supplant it.

It should be noted that the combinations as they occur in column addition are in the form 24 and 5, and not 5 and 24. For this reason the former should be the form used by the teacher in both oral and written combinations. After studying a lesson through Step B, the pupils should

be able to answer readily, regarding each combination, such questions as the following for the combination 5 and 4: How many are 5 and 4? How many are 35 and 4? 65 and 4? 95 and 4? If a 4 is added to a number ending in 5, the answer will end in what number? Before taking up the addition columns, it is expected that the teacher will give oral drills of this kind upon all of the combinations of a lesson after they have been studied through Step B.

Step C. As the combinations are arranged in the several lessons, the sum of the first combination is made the lower number in the second combination, the sum of the second combination is made the lower number in the third combination, etc. This arrangement is for the purpose of constructing addition columns involving the combinations of the lesson. With the combinations on the board for reference, arranged as in Lesson A, unite them to form short columns, thus:

				2	6
	3		2	3	2
4	4	3	3	4	3
3	3	4	4	3	4
2	2	5	5	2	5
—	—	—	—	—	—

In the combination 2 and 3 in the lesson, let the pointer rest on 3. Pass it to the 3 in the first of these columns. The pupil will recognize the combination and will give the sum, 5. Move the pointer to the 4. If the pupil hesitates, pass the pointer to the combination 5 and 4 in the lesson. When the sum has been given, return to the column and add. The pupil will soon see that the 2 and 3 in the column stand in the same relation to 4 as the 5 does in the combination in the lesson. If in the addition of a column the pupil fails to add correctly any given combination, say 17 and 6, do not ask him what 7 and 6 make, but drop the column and take up the study of the combination 7 and 6 through Steps A and B. Return to the column, and if the drill on the

single combination was thorough, the pupil will be able to add the column.

Step C consists in adding the columns as indicated in Step C, pp. 48, 49. The pupil should begin the addition of a column by naming the sum of the combination at the foot of the column. The columns should be added with a regular cadence. Perfect knowledge of the combinations, together with right habits of work, will keep the pupil from resorting to serial counting as a means of finding the sums. For the fixing of these habits, much of the work on addition for the first few lessons should be oral.

SUBTRACTION

Each lesson in addition is followed by a corresponding lesson in subtraction, and the same combinations are involved in both. Subtraction is the operation of finding the difference between two quantities. This difference may be found by taking from the greater of the two quantities an amount equal to the lesser quantity; or it may be found by adding to the lesser quantity such an amount as will make it equal to the greater. The amount remaining in the one case is the amount added in the other case. Applied to the solution of problems in subtraction, these methods are as follows:

Problem 1: Fred has 5 marbles. Walter has 3 marbles. How many more marbles has Fred than Walter?

Problem 2: Fred had 5 marbles. He lost 3 of them. How many marbles has he left?

By the first method, a quantity equal in amount to the number of marbles Walter has is taken from the number of marbles Fred has, and the remaining number is the difference, or answer. This is expressed in the language

of subtraction: Three marbles from 5 marbles leave 2 marbles; or 5 marbles less 3 marbles are 2 marbles.

By the second method, such an amount is added to the smaller quantity as will make it equal to the larger quantity. This is expressed in some such language as: "3 marbles and how many marbles are 5 marbles?" Or, "3 marbles and what are 5 marbles?" Or, "3 marbles and 2 marbles are 5 marbles," — a form embodying the answer. The answer, 2 marbles, is part of the number fact involved in the addition form previously learned, when 3 marbles and 2 marbles were added to make 5 marbles. In the second problem, in which the difference between a given quantity and a part of itself is required, there is no essential difference in the way of finding the part remaining.

The method of subtraction recommended for use in connection with the exercises of this text is the second of the above methods, which is the so-called "Austrian method." It is also known as the "additive method," and is sometimes spoken of as the "computors' method" or the "method of making change." Its advantage lies in the fact that the number facts of addition are used to find the differences in subtraction. After the addition combinations have been memorized, no new number facts are necessary in order to perform the operation of subtraction. The pupil has only to learn how to apply to a new mode of expression the knowledge that he has already acquired. This he learns to do without much difficulty.

The addition combination $\begin{array}{r} 3 \\ 2 \\ \hline 5 \end{array}$ is read, 2 and 3 are 5. The corresponding subtraction $\begin{array}{r} 5 \\ -\ 2 \\ \hline 3 \end{array}$ is read, 2 and what are 5, or 2 and how many are 5, or simply 2 and **3** are 5.

Subtract thus: 5 and **4** are 9; 3 and **2** are 5. Write the 4 under the 5 and the 2 under the 3. That is, supply the figure required in each column in order to obtain the sum at the top.

$$\begin{array}{r} 59 \\ -35 \\ \hline 24 \end{array}$$

If the figure in the subtrahend represents an amount larger than the corresponding figure in the minuend, subtract thus: $\begin{array}{r} 52 \\ -29, \\ \hline 23 \end{array}$ 9 and **3** are 12; carry 1 to 2 as in addition, making it 3; 3 and **2** are 5. The answer is 23.

This method of subtraction may also be explained as follows: Compare $\frac{5}{-3}$, $\frac{15}{-13}$, $\frac{25}{-23}$. If both the minuend and the subtrahend are increased by the same amount, the difference is not changed. The steps necessary to find the difference may be explained thus: It is evident that there is no number (excepting a negative quantity) which added to 9 makes 2; so 10 is added to the 2, changing that number to 12. Nine and **3** make 12. Ten must, therefore, be added to the subtrahend to equalize this change. This is done by increasing the next lower number by 1. This changes the 2 to 3. Three and **2** make 5. The answer is 23.

This may be given: 9 from 12 leaves 3. 3 from 5 leaves 2, if the teacher prefers to use this language form to express the operation. The two language forms should not be confused. The 2 in the minuend is increased by the addition of 10, and the lower number in the next combination is increased by 1 to equalize this change, as above.

Again, the minuend is the sum of two numbers. The subtrahend is one of the numbers. The other number is a number which added to the subtrahend will make the minuend.

( ) difference, or other addend.	72 minuend.
27 subtrahend, or given addend.	− 27 subtrahend.
72 minuend, or sum of addends.	45 difference.

Explanation: 7 and **5** make 12. Write 5 as the units' figure in the missing addend, and add the 1 ten to the 2 tens of the other addend. 3 and **4** make 7. 45 is the missing addend.

The method of subtraction involving the "borrowing" of 1 ten from the next place in the minuend, etc., should not be used in the exercises of this text, as the combinations would thereby be changed. Do not permit pupils to acquire the habit of making these changes in the written work.

MULTIPLICATION

Facility in multiplication and division, as in addition and subtraction, is acquired only by much practice. Each lesson in multiplication consists of a few number facts which are to be memorized perfectly, and then used until accuracy and facility in handling these have been acquired. The number facts of each lesson should become perfect reflexes before the new facts of the succeeding lesson are introduced. Much drill work is provided for in the text. This should be supplemented by similar material in case the pupils have not acquired the desired skill in handling the facts of each lesson. No provision has been made for the mastery of the "tables" as such. Each fact must finally be known without reference to the table to which it belongs. A table of products and quotients is given near the close of the chapter on multiplication and division. It is for reference merely. Such multipliers as 20, 30, etc., are introduced before multipliers like 23, 34, etc., since the

arrangement of the product with the first class of multipliers is more nearly like that with multipliers of one place.

Facility in the mechanical work of multiplication requires not only a ready knowledge of the several products, but also the ability to find readily the sum of the product and some given number, — the number to be "carried." This is provided for in the drill exercises that follow each set of facts in multiplication. This furnishes a constant review of the addition combinations as well as the desired practice in adding a number to each product.

DIVISION

Each lesson in multiplication is followed by a corresponding lesson in division. The study exercises in both should be thoroughly mastered before attempting the exercises which follow. With one place divisors, short division is used. The pupils should acquire the habit of using the shorter method with divisors of one place. The several steps in long division are taught when occasion arises for their use. A special method is employed in the subject of long division. Much time is usually wasted by the pupil in the attempt to find the correct quotient figure, with the result that pupils become discouraged and acquire a dislike for the work. A method is here presented by which the correct quotient figure may be found with little difficulty. (See pp. 178–186.) The teacher should acquaint herself with the method and should see that the pupils are perfectly familiar with it before they are required to use it. Time spent in mastering it will be time saved. A study of divisors with reference to determining the quotient figure is given in the text. The pupils should be taught to inspect closely each new

divisor before attempting to use it. Use only such divisors as properly belong in each of the classes into which they are grouped in the text.

A divisor of one place is used in presenting the several steps in long division. This is accompanied by a second illustration in which the divisor consists of two places. The authors are quite certain that many teachers will secure better results by teaching the steps in long division in connection with divisors of two places. Until the process has been thoroughly learned, use as divisors numbers in which the second figure is the same as or less than the first figure ; as, 44, 55, 84, 32, 43, 75, 97, etc.

CHAPTER III

ADDITION AND SUBTRACTION

NOTATION, NUMERATION, OBJECTIVE FRACTIONS, COMPOUND NUMBERS, MULTIPLICATION, AND DIVISION

1. 1. One ten and two ones are how many ones?

2. One ten and seven ones are how many ones?

3. Twelve ones are one ten and — ones.

4. Eighteen ones are — ten and — ones.

5. Twenty ones are — tens.

6. Two tens and three ones are — ones.

7. Twenty-five ones are — tens and — ones.

8. Two tens and seven ones are — ones.

9. Three tens are — ones. Four tens are — ones.

10. Eighty ones are how many tens?

11. Nine tens and six ones are — ones.

12. Seventy-eight ones are — tens and — ones.

13. Ten ones are — ten. Ten tens are — ones.

14. How many tens are there in seventy ones?

15. How many tens are there in eighty ones?

16. Sixty ones are — tens. Eighty ones are — tens.

2. 1. Five tens and no ones are — ones.

2. Five tens and nine ones are — ones.

3. Twenty-four ones are twenty ones and — ones.

4. Thirty-six ones are thirty ones and — ones.

5. Twenty-three apples are twenty apples and — apples.

6. Thirty-seven cents are thirty cents and — cents.

7. Forty-eight children are forty children and — children.

8. Sixteen boys are ten boys and — boys.

9. Eighteen oranges are ten oranges and — oranges.

10. Twenty girls and six girls are — girls.

11. Thirty marbles and eight marbles are — marbles.

12. Forty girls and ten girls are — girls.

13. Twenty cents and ten cents are — cents.

14. Twenty-four days and ten days are — days.

15. Thirty-six days and ten days are — days.

16. Sixteen boys and ten boys are — boys.

17. Seven boys and ten boys are — boys.

18. Nine birds and ten birds are — birds.

19. Ten oranges and six oranges are — oranges.

20. Ten books and four books are — books.

21. Eight pencils and ten pencils are — pencils.

22. What number is ten more than thirty?

23. What number is ten more than seventy?

24. Thirty-five is ten more than —. Thirty-six is ten more than —.

25. Forty-six is how many more than thirty-six?

26. Sixty-eight is how many more than fifty-eight?

3. 1. There are — 100's in 400. There are — 1's in 400.

2. There are — 100's in 1000. Count by 100's to 1000.

3. What number is one hundred more than 60?

4. What number is one hundred more than 67?

5. What number is one hundred more than 167?

6. What number is one hundred more than 625?

7. Write a number that tells 9 tens and 4 ones.

8. Write a number that tells 2 hundreds, 6 tens, and 8 ones.

4. 1. What number is one more than 6?

2. What number is one more than 16?

3. What number is one more than 13?

4. What number is one more than 20?

5. What number is one more than 29?

6. What number is one less than 4?

7. What number is one less than 9?

8. What number is one less than 20?

9. What number is one less than 29?

10. What number is one less than 40?

5. Write in figures:

1. Twenty and eight are —.
2. Forty and five are —.
3. Eighty and nine are —.
4. Ten and six are —.
5. Fifty and two are —.
6. Forty and seven are —.

6. Read these numbers:

678	390	1,357	7,006	4,800	10,064
804	862	1,048	8,070	5,630	12,006

Tell what each figure in the above numbers stands for.

7. Write in figures:

1. Thirty-eight. 2. Four hundred seven. 3. Eight hundred sixty. 4. Nine hundred. 5. Three hundred sixty-five. 6. Seven hundred eighteen. 7. Two hundred twelve. 8. One thousand seven. 9. Four thousand three hundred twenty. 10. Six thousand sixty.

8. 1. Count by tens to 122, beginning with 2.

2. Count by tens to 125, beginning with 5.
3. Count by tens to 129, beginning with 9.
4. Count by tens to 124, beginning with 4.
5. Count by tens to 123, beginning with 3.
6. Give a number story for this: *

$$\begin{array}{r} 3 \text{ birds} \\ +\,2 \text{ birds} \\ \hline 5 \text{ birds} \end{array}$$

7. Give a number story for this:

$$\begin{array}{r} 9 \text{ boys} \\ -\,5 \text{ boys} \\ \hline 4 \text{ boys} \end{array}$$

* See p. 31.

ADDITION — LESSON A

9. 1. *Memorize the following:*

3	4	3	2	6
2	5	9	2	4
5	9	12	4	10

2. Give a number story suggested by each.

MODEL: There were 2 books on the table. Mary put 3 more books on the table. There were then — books on the table.

10. Oral Problems.*

1. Four boys and five boys are — boys.
2. Nine girls and three girls are — girls.
3. Six apples and four apples are — apples.
4. How many are two books and three books?

Answer: Two books and three books are five books.

5. How many are three chairs and nine chairs?
6. How many are four feet and six feet?
7. Five days and four days are how many days?
8. Two hours and two hours are how many hours?
9. A girl paid five cents for a ribbon and four cents for a tablet. How much did she pay for both?

The answer in addition is called the **sum**.

* In this and similar exercises the teacher is expected to dictate additional problems involving the combinations of the lesson. Place the combinations on the board without answers and have the pupils make problems for one another to solve. Correct answers should be given in correct language.

11. Study Exercises.

3	4	3	2	6
2	5	9	2	4
9	4	2	2	5
3	6	2	3	4

HOW TO STUDY ADDITION*

After the combinations have been memorized, the *study* of the lesson in addition is to be taken up as indicated in Steps A, B, and C, as follows :

Step A. Study the combinations, without answers as above, until you can give each result without hesitation. In studying a combination, direct the thought to the upper number, as for the present we shall begin at the foot of the column to add. Pass from one combination to another. Continue the study until you can give the sums as readily as you can read: 5, 9, 12, 4, 10.

Step B. Mentally place 1 ten before each of the lower numbers in the upper set of combinations and add: 12, 15; 15, 19; 19, 22; 12, 14; 14, 20.

Pass to the lower set of combinations, add 2 tens to the lower numbers, and add: 23, 32; 26, 30; 22, 24; 23, 25; 24, 29.

Return to the upper set, and mentally place 3 tens before each of the lower numbers, and add: 32, 35; 35, 39; etc.

* The teacher should explain each step carefully. It is important that the pupils learn at the start how to study the addition exercises correctly.

Pass again to the lower set, then return to the upper set, each time increasing the number of tens until 10 tens are added, and the combinations add: 103, 112; 106, 110; etc. The columns to be added are made up of the combinations studied in Step B.

Step C. Begin at the foot of the column and add as in Column *c* below: 5, 9, 12, 14, 20.

Mentally place 1 ten before the number at the foot of the column, and add: 12, 15, 19, 22, 24, 30.

Mentally place 2 tens before the number at the foot of the column and add. Increase the number of tens until the column is added: 102, 105, etc.

12. Oral Drill.*

Give the sums of:

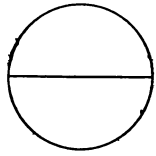
1.	15 and 4.	5.	29 and 3.	9.	56 and 4.	13.	23 and 9.
2.	24 and 5.	6.	22 and 3.	10.	74 and 6.	14.	42 and 2.
3.	19 and 3.	7.	36 and 4.	11.	13 and 2.	15.	69 and 3.
4.	16 and 4.	8.	44 and 5.	12.	12 and 3.	16.	65 and 4.

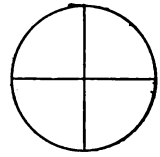
13. Oral Exercises.

Add as indicated in Step C above.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
		6	5	3	4	2	2	2	3	2	3	4	6
		2	6	6	3	3	3	3	3	3	5	6	4
	3	3	2	2	3	4	5	4	9	5	2	4	6
4	4	4	3	3	9	3	2	5	6	2	2	6	4
3	3	3	4	4	6	3	9	4	2	3	6	4	6
2	2	2	5	5	4	9	3	6	2	9	4	6	4

* Oral drill should be given upon all of the combinations in each of the study exercises before taking up the addition of the columns.





14. 1. One whole is — halves.

2. One whole is — fourths.

3. One half is — fourths.

4. Two fourths and one fourth are — fourths.

5. One half and one fourth are — fourths.

6. Two fourths less one fourth is — fourth.

7. One whole less one fourth is — fourths.

8. If a pie is cut into two equal pieces, one of the pieces is — half of the pie.

9. If one half of a pie is cut into two equal pieces, one of the pieces is — — of the pie.

10. A woman divided a pie equally among some children. There were four children. Each child received — — of a pie.

11. Harry had one half of a pie. George had one half as much as Harry. George had — — of a pie.

12. Two wholes are — halves.

13. A woman had two pies. She gave three boys each one half of a pie. How much pie had she left?

14. Fold a paper into four equal folds.

SUBTRACTION — LESSON A

15. 1. *Memorize the following:*

9	12	5	10	4	9	12	5	10
−4	−9	−2	−4	−2	−5	−3	−3	−6
5	3	3	6	2	4	9	2	4

The exercise at the right is read, 6 and how many are 10? The answer is —.

2. Read the above exercises, beginning at the right.

3. Give a number story suggested by each.

MODEL: Fred had 10 apples. He gave 6 of them to James. Fred had — apples left.

16. Oral Problems.

1. Four books and — books are nine books.

2. Two days and — days are five days.

3. Nine months and — months are twelve months.

4. Five chairs are three chairs and — chairs.

5. Ten weeks are six weeks and — weeks.

6. Nine boys are four boys and — boys.

7. There were five girls in a room. Three of them were seated. How many were not seated?

8. A boy had five apples. He gave away two apples. He had — apples left.

9. There were ten words on the blackboard. Lottie erased six of the words. How many words were left on the blackboard?

17. Study Exercises.

9	12	5	10	4	9	12	5	10
−4	−9	−2	−4	−2	−5	−3	−3	−6

Study the above exercises until you can give the answers as readily as you can read these numbers: 5, 3, 3, 6, 2, 4, 9, 2, 4.

18. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1.	59	95	55	95	50	90	99	92	44
	−24	−53	−30	−40	−50	−50	−40	−50	−22
2.	125	109	124	105	129	103	122	100	120
	−93	−44	−32	−60	−30	−43	−92	−40	−90

19. Written Exercises.

In Exercise *a* below, the 9 is greater than the 2 above it, so we say 9 and **3** are 12. We then add 1 to the next lower number. This changes it to 3. We then say 3 and **2** are 5.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
1.	52	52	92	92	90	50	40	90	50
	−29	−23	−49	−33	−44	−26	−14	−36	−14

	a	*b*	*c*	*d*	*e*	*f*
2.	$55	100 in.	90 ft.	50 yd.	102 gal.	44 in.
	−$23	−36 in.	−46 ft.	−30 yd.	−59 gal.	−22 in.
	$	in.	ft.	yd.	gal.	in.

ADDITION AND SUBTRACTION — LESSON A

20. Oral Problems.

1. A boy paid $3 for a pair of shoes and $2 for a hat. How much did he pay for both?

2. Nine ducks were swimming on a pond. Five flew away. How many ducks were left on the pond?

3. A boy threw at a mark. He missed it 6 times and struck it 4 times. How many times did he throw?

4. Twelve girls were invited to a party. Three of the girls were not able to go. How many girls went to the party?

5. A boy spent part of his vacation in camping out and the rest of it in the city. He camped for 9 weeks and was in the city 3 weeks. How long was his vacation?

6. A girl had a ribbon 5 yards long. She cut off a piece 2 yards long. How long was the part that was left?

7. A boy had 10 cents. He bought a tablet for 4 cents. How much money did he have left?

8. If it takes 2 yards of cloth to make an apron, how many yards will it take to make two aprons?

What is the answer in addition called?

The answer in subtraction is called the **difference**, or **remainder**.

21. Written Exercises.

Begin with Exercise *a* and add the right-hand column, thus: 9, 12, 14. Write the 4 under the column. Add the 1 to the 1 at the foot of the next column, and add: 2, 4, 9, 12.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
632	223	393	255	543	544	820	260
253	339	444	322	255	236	633	324
324	444	202	493	342	902	244	436
815	436	253	429	852	312	155	380

22. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	925	120	504	422	950	502	900
	−392	−84	−142	−189	−414	−139	−356

	a	*b*	*c*	*d*	*e*
2.	$520	$1000	922 in.	502 ft.	400 yd.
	−$286	−$354	−419 in.	−293 ft.	−196 yd.

23. Written Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
943	353	693	524	336	539	546	462
334	363	234	93	32	406	634	323
635	924	363	633	493	642	236	329
246	633	429	245	64	233	342	466
134	282	303	54	325	109	832	324

24. Written Problems.

1. A man bought a horse for $90 and a harness for $30. How much did he pay for both?

2. There were 59 ducks on a pond. Twenty-five of them flew away. How many ducks were left on the pond?

Model for Addition		Model for Subtraction	
$90	cost of horse	59	ducks on pond
+ $30	cost of harness	− 25	ducks flew away
$120	cost of both	34	ducks left on pond

3. There are 23 girls in Room A and 32 girls in Room B. How many girls are there in both rooms?

4. There were 55 pupils in a room. Thirty-two pupils left the room. How many pupils remained in the room?

5. A boy had 95 cents. He spent 50 cents. How much money had he left?

6. A farmer had 29 cows. He bought 23 cows. How many cows did he then have?

7. Fred has 23 marbles. James has 32 marbles. How many marbles have both?

8. A man bought a wagon for $50 and a team of horses for $240. How much did both cost him?

9. A grocer sold 62 pounds of sugar on Monday and 43 pounds on Tuesday. How many pounds did he sell on both days?

ONE PINT

ONE QUART

ONE GALLON

25. 1. *Two pints are one quart.**

2. *Four quarts are one gallon.*

3. One pint is — half of one quart.

4. One quart is — times one pint.

5. Two pints and two pints are — pints.

6. The ratio of a quart to a pint is 2.

7. The ratio of a gallon to a quart is —.

8. One quart is — fourth of a gallon.

9. Two quarts are — fourths of a gallon.

10. Three quarts are — fourths of a gallon.

11. One pint and one quart are — pints.

26. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*
1.	1200	4529	9240	2295	3520	3224
	−260	−290	−4314	−342	−186	−832
2.	4535	4502	5200	9549	3005	1902
	−2230	−2493	−2256	−5240	−543	−340

* Review Lesson VIII, p. 23, before taking up the study of this page.

ADDITION — LESSON B

27. 1. *Memorize the following:*

3	4	3	2	2
6	9	3	6	8
9	13	6	8	10

2. Give a number story suggested by each.

3. A boy had 9 marbles. He bought 4 marbles. He then had — marbles.

4. Six oranges and 3 oranges are how many oranges?

5. Eight tons of coal and 2 tons of coal are — tons of coal.

6. There are — 3's in 6. There are — 2's in 4.

7. There are — 3's in 9. How do you know this?

8. Two hats and — hats are 10 hats.

9. Nine boys and — boys are 13 boys.

10. Eight cents and — cents are 10 cents.

11. Harry has 6 books and Willie has 3 books. The two boys together have — books.

12. There are 9 girls in the first row and 4 girls in the second row. There are — girls in the two rows.

13. Mary picked 6 boxes of berries in the morning and 2 boxes in the afternoon. She picked — boxes during the day.

14. Ethel has two pieces of ribbon. There are 4 yards in the first piece and 9 yards in the second. In the two pieces there are — yards.

28. Study Exercises.

Study as indicated in Steps A and B, pp. 48, 49.

3	4	3	2	2
6	9	3	6	8
6	8	3	9	6
2	2	3	4	3

To THE TEACHER. Give oral drill on the combinations in the above study. See p. 49.

29. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
2	8	3	2	3	4	4	2	3	4	6	6	8	3
2	2	4	3	4	9	3	3	4	9	4	2	2	3
3	2	3	4	9	2	3	4	9	2	6	2	6	4
4	3	3	3	2	2	3	9	2	2	4	3	2	6
3	4	9	3	2	3	2	2	6	3	6	9	8	9
6	9	4	3	6	3	8	8	2	3	3	4	2	4

DOLLARS AND CENTS

30. $3.50 is read three dollars and fifty cents.

$3.60 is read three dollars and — cents.

$3.05 is read — dollars and five cents.

$.05 is read — cents. $.50 is read — cents.

The point (.) separates dollars from cents.

Write the following in a column, cents under cents and dollars under dollars, and add:

$.34, $2.36, $.03, $6.42, $1.08, $.30.

SUBTRACTION — LESSON B

31. 1. *Memorize the following:*

9	13	8	10	6	9	13	8	10
−3	−4	−2	−8	−3	−6	−9	−6	−2
6	9	6	2	3	3	4	2	8

2. Give a number story suggested by each.

3. Two girls and how many girls are 10 girls?

4. Nine days and how many days are 13 days?

5. Eight cents and how many cents are 10 cents?

6. Three feet and — feet are 9 feet.

7. Four weeks and — weeks are 13 weeks.

8. Six yards and — yards are 8 yards.

9. Ten cents are 2 cents and — cents.

10. Nine days are 3 days and — days.

11. Thirteen weeks are 4 weeks and — weeks.

12. A boy had 13 weeks' vacation. He spent the first four weeks of it in the country. How many weeks of his vacation were left?

13. A girl bought a 2-cent stamp. She handed the postmaster a dime. He gave her back — cents change.

14. There were 9 girls in a room. Three of them were reading. The others were drawing. How many girls were drawing?

15. A boy has 13 examples to work. After he has worked 4 of them, how many will he then have to work?

32. Study Exercises.

9	13	8	10	6	10	9	13	8
−3	−4	−6	−2	−3	−8	−6	−9	−2

Study the above exercises until you can give the answers without hesitation.

33. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	139	90	98	63	808	136	138	109
	−93	−58	−66	−29	−582	−43	−96	−83

	a	*b*	*c*	*d*	*e*	*f*
2.	9390	6908	9803	8803	8003	9433
	−2392	−3580	−6199	−2514	−5720	−3384

	a	*b*	*c*	*d*	*e*	*f*	*g*
3.	104	103	203	502	639	503	193
	−82	−59	−134	−179	−99	−279	−84

	a	*b*	*c*	*d*	*e*	*f*	*g*
4.	938	902	603	1090	1036	500	620
	−246	−593	−214	−836	−990	−172	−90

34. Oral Exercises.

Add:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
30*	40	30	20	60	30	30	50	20	20
20	90	90	20	40	60	30	40	80	60

* Dictate to the class thus: 20, 30. The pupils add: 20, 50.

ADDITION AND SUBTRACTION — LESSON B

35. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
9	4	8	6	3	4	3	8	4	4	3	2	4	9
3	3	3	2	4	3	9	2	3	6	9	2	8	8
4	2	6	6	2	6	4	8	3	8	2	3	2	3
3	8	4	3	3	2	4	2	9	9	8	4	6	4
4	9	4	6	6	2	3	8	2	9	4	3	2	2
9	3	5	3	4	6	3	2	8	4	6	6	2	3

36. Oral Problems.

1. One year is — months. One foot is — inches.

2. A boy attends school 9 months in the year. How many months of vacation does he have?

3. A line 1 foot long is divided into two parts. One part is 3 inches long. The other part is — inches long.

4. Walter has 4 apples and George has 9 apples. George has how many more apples than Walter?

5. Two is one half of —. One half of 6 is —.

6. There were 10 pints of milk in a can. Four pints were sold. How many pints of milk were left?

7. A boy poured 2 pints of water into a gallon can. The can will hold — more pints.

8. What is the sum of $6 and $3? Of $3 and $9?

9. A boy picked 9 boxes of berries. He sold 4 of them. How many boxes of berries had he left?

37. Written Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
423	229	736	322	763	722	333	227	343
964	362	242	364	624	696	442	636	633
629	432	633	429	232	242	328	852	433
232	593	343	982	394	398	646	343	994
242	864	943	262	323	443	612	964	663
836	929	833	626	366	239	262	825	226

38. Written Problems.

Write the cost of the second purchase under the cost of the first, and the cost of the third purchase under the cost of the second, etc.

1. A man bought a horse for $43, a buggy for $44, a harness for $23, and $26 worth of hay and feed. How much did he pay for all?

2. A grocer sold 228 pounds of sugar on Monday, 333 pounds on Tuesday, 546 pounds on Wednesday, 44 pounds on Thursday, 234 pounds on Friday, 95 pounds on Saturday. How many pounds of sugar did he sell in the six days?

3. What is the sum of $3.94, $6.33, and $8.96?

4. How much more is $9.30 than $5.32?

39. Written Exercises.

a	*b*	*c*	*d*	*e*	*f*
1032	1204	8343	5023	9826	6600
−739	−224	−2319	−1124	−4620	−3298

40. Written Problems.

1. A farmer had 93 sheep. He sold 34 sheep. How many sheep did he have left?

2. A boy was flying a kite with a string 400 feet long. The string broke. The piece in the boy's hand was 220 feet long. What was the length of the piece on the kite?

3. There are 48 pupils in Room A and 26 pupils in Room B. How many more pupils are there in Room A than in Room B?

4. There are 48 pupils in Room A, 26 pupils in Room B, and 24 pupils in Room C. How many pupils are there in the three rooms?

5. A man had 123 miles to travel. He traveled 84 miles the first day, and finished his journey on the next day. How far did he travel the second day?

41. Find the amount of gain or loss:

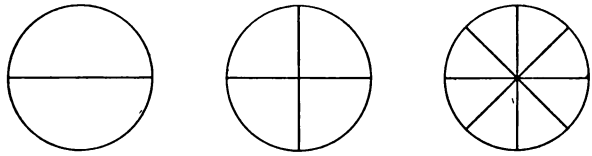
1. A man bought a horse for $120. He sold it for $88.

2. A man bought land at $95 an acre. He sold it at $63 an acre.

3. A boy bought a pony for $26. He sold it for $50.

4. A grocer bought flour at $.74 a sack. He sold it for $1.00 a sack.

5. A horse that cost $90 and a buggy that cost $40 were both sold for $145.



42. 1. In one whole there are — halves.

2. In one whole there are — fourths.

3. In one whole there are — eighths.

4. In one half there are — eighths.

5. One half and one fourth are — fourths.

6. One half and one eighth are — eighths.

7. One half less one eighth is — eighths.

8. One half less two eighths is — eighths.

9. Four eighths are — times one eighth.

10. Three fourths are — eighths. Six eighths are — fourths.

11. A boy ate one fourth of a pie. How much of the pie was left?

12. Three boys each ate one fourth of a pie. There was left — fourth of a pie.

13. A boy had one fourth of a pie. He cut it into two equal parts to share it with another boy. Each boy had — eighth of a pie.

14. A boy paid 2 cents for one half dozen apples. At the same rate, a dozen apples would cost — cents.

15. Using lines, show one half, one fourth, and one eighth.

ADDITION — LESSON C

43. 1. *Memorize the following:*

2	8	4	5	7
4	6	4	8	3
6	14	8	13	10

2. Give a number story suggested by each.

3. A boy bought a lead pencil for 5 cents and a tablet for 8 cents. How much did he pay for both?

4. Count by 2's to 10. Count by 3's to 12.

5. Two 4's are —. One half of 8 is —.

6. In going home from a store a boy carried 4 pounds of sugar and 2 pounds of coffee. What was the weight of both packages?

7. A girl lives 4 blocks from the schoolhouse. How many blocks must she walk in going home and back at noon?

8. What is the sum of $8 and $5? Of $6 and $8?

9. There are 6 boys and 8 girls in a class. How many pupils are there in the class?

10. Seven years and — years are ten years.

11. George has 8 rabbits and James has 6 rabbits. Together they have — rabbits.

44. Read the following:

625,504	104,025	$ 250.50	$ 1,050.75
308,800	625,250	$ 305.25	$ 4,306.20
700,040	300,405	$ 670.07	$ 8,004.05

45. Study Exercises.

Study as indicated in Steps A and B, pp. 48 and 49.

2	8	4	5	7
4	6	4	8	3
8	3	4	6	4
5	7	4	8	2

To THE TEACHER. Give oral drill on the combinations in the above study. See p. 49.

46. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
7	8	2	8	4	5	8	5	7	7	8	4	3	7
5	7	4	2	8	8	6	4	5	8	2	8	7	3
4	5	7	4	4	7	7	6	8	5	8	2	3	7
8	4	5	7	2	3	5	4	7	7	6	6	7	3
2	8	4	5	7	3	4	8	5	8	7	4	7	3
4	6	4	8	3	7	4	6	8	5	3	4	3	7

47. Oral Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
20	80	40	50	70	40 *	30	40	60	30
40	60	40	80	30	42	24	58	87	95

Dictate problems, thus: A boy sold 40 papers in the morning and 20 papers in the evening. How many papers did he sell during the day?

* Dictate thus: 42, 40. The pupils add: 42, 82.

SUBTRACTION — LESSON C

48. 1. *Memorize the following:*

10	14	6	13	8	13	14	6	10
−3	−6	−4	−5	−4	−8	−8	−2	−7
7	8	2	8	4	5	6	4	3

2. Write number stories suggested by each.

3. Three boys and — boys are ten boys.

4. Thirteen days are 8 days and — days.

5. The difference between $ 14 and $ 6 is $ —.

6. A boy has $ 3. How many more dollars must he have in order to pay for a suit of clothes that costs $ 10?

7. What must be added to 4 to make 6? To 6 to make 14?

8. What must be added to 8 feet to make 14 feet?

9. Two inches and — inches are 6 inches.

10. Ten is how many more than seven?

11. How much more is 10 pounds than 7 pounds?

12. Mary worked 13 problems. Alice worked 8 problems. How many more problems did Mary work than Alice?

13. A girl picked 14 flowers. Eight of them were roses. The rest were pinks. She picked — pinks.

14. What is 5 less than 13? What is 7 more than 3?

49. Study Exercises.

10	14	6	13	8	6	13	14	10
−3	−6	−4	−5	−4	−2	−8	−8	−7

Study the above exercises until you can give the answers without hesitation.

50. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	104	146	638	1366	863	634	1404
	−26	−64	−154	−542	−418	−228	−796

	a	*b*	*c*	*d*	*e*	*f*	*g*
2.	1400	1033	6340	3604	1068	4034	1000
	−717	−248	−1773	−566	−724	−946	−627

	a	*b*	*c*	*d*	*e*	*f*
3.	1403	1334	1432	9476	6304	9030
	−515	−842	−573	−870	−3766	−3136

	a	*b*	*c*	*d*	*e*
4.	$ 60.20	$ 82.83	$ 50.34	$ 10.23	$ 40.69
	−$ 27.87	−$ 13.14	−$ 17.46	−$ 6.19	−$ 2.30

51. Oral Problems.

1. A man had 13 horses. He sold 8 of them. He had — horses left.

2. What is the sum of 6 inches and 8 inches?

3. A girl had 50 cents. She spent 20 cents for some ribbon. She had — cents left.

4. How many pints are one gallon?

5. If each family takes a quart of milk, a gallon of milk will supply — families.

6. There are 24 boys and 20 girls in a school. There are — pupils in the school.

7. There were 13 ducks on a pond. Nine of them flew away. There were — ducks left on the pond.

8. A boy bought a tablet for 10 cents and some marbles for 8 cents. How much money did he spend?

9. Ten days are a week and — days.

10. What is the answer in subtraction called?

11. There were 14 roses on a bush. Lottie picked 6 of them. There were — roses left on the bush.

12. There were 6 birds in a tree. Four of them flew away. There were — birds left in the tree.

13. There were 13 children at a party. Five of them were boys. How many girls were at the party?

14. Mary has 8 cents. Ethel has 6 cents more than Mary. Ethel has — cents.

15. Harry is 9 years old. Willie is 3 years older than Harry. Willie is — years old.

16. Alice missed 3 words in her spelling lesson. She had 12 words to spell. She spelled — words correctly.

52. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
4	5	6	8	6	8	9	4	6	8	4	3	9	7
6	4	4	9	8	4	8	3	8	9	2	4	8	5
2	2	6	3	5	9	2	4	3	4	4	6	3	4
6	9	9	7	8	4	6	2	5	6	3	9	3	8
7	5	8	9	9	6	4	6	6	4	8	2	4	2
3	8	6	4	3	3	4	4	2	9	5	2	5	4

53. Written Problems.

1. A farmer had 400 acres of land. He sold 177 acres. How many acres had he left?

2. A farmer had 27 acres of land. He bought 13 acres. How many acres did he then have?

3. Mary has 68 cents. Ethel has 36 cents. How much money have they both?

4. A tailor had a piece of cloth containing 38 yards. He cut from it 16 yards. How many yards were left in the piece?

5. A girl had 90 cents. She spent 28 cents. How much money did she have left?

6. John and James together have $1.00. James has $.34. How much money has John?

7. A horse and buggy cost $200. The horse cost $120. What was the cost of the buggy?

8. Fred weighs 102 pounds. Harry weighs 79 pounds. How much heavier is Fred than Harry?

54. Oral Exercises.

1. There are — inches in one foot.
2. There are — feet in one yard.
3. There are — feet in 3 yards.
4. Six feet are — yards. Twelve feet are — yards.
5. Six pints are — quarts. Eight pints are — quarts.
6. Three quarts are — pints. Four quarts are — pints.
7. There are — days in one week. One year is — months.
8. Seven feet are — yards and — foot.
9. Ten days are — week and — days.
10. Name the months of the year. Which have 31 days?

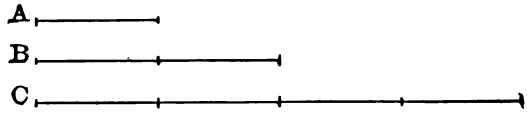
55. Written Exercises.

Add:

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	294	252	995	839	399	963	732
	367	243	852	236	416	187	202
	425	263	344	434	442	832	283
	934	283	569	558	353	258	304
	246	265	884	622	344	466	430
	628	328	679	634	685	594	809

Subtract:

	a	*b*	*c*	*d*	*e*
2.	$44.32	1436 ft.	9308 ft.	$98.30	4344 yd.
	$23.39	582 ft.	5882 ft.	$41.80	758 yd.



56. 1. Line A is — half of line B.

2. Line B is — half of line C.

3. Line A is — fourth of line C.

4. Line B is — fourths of line C.

5. Line B is — times line A.

6. Line C is four times line — .

7. Line C is two times line — .

8. If line A represents 1 foot, line B represents — feet, and line C represents — feet.

9. If line A represents 2 feet, line B represents — feet, and line C represents — feet.

10. If line A represents 3 inches, line B represents — inches, and line C represents — inches.

(*a*) (*b*)

57. 1. Divide group *a* into two equal groups.

2. Divide group *b* into four equal groups.

3. Two dots are — half of four dots.

4. One dot is — fourth of four dots.

5. If each dot represents $1, in group *a* there are $ —.

6. $2 is — half of $4. $4 and $4 are $ — .

7. $4 is — times $2. One half of $4 is $ — .

ADDITION — LESSON D

58. 1. *Memorize the following:*

2	6	5	7	5
5	7	3	8	5
7	13	8	15	10

2. Write a number story suggested by each.

3. How many are 7 boys and 6 boys?

4. How many are 7 girls and 8 girls?

5. How many are 5 cents and 5 cents?

6. What is the sum of 3 yards and 5 yards?

7. What is the sum of $2 and $5?

8. Six days and 7 days are — days.

9. Eight weeks and 7 weeks are — weeks.

10. Seven hours are 5 hours and — hours.

11. Ten miles are 5 miles and — miles.

12. There were 5 birds in a tree. Three other birds came to the tree. There were then — birds in the tree.

13. A boy had $6 in his bank. He put $7 into the bank. He then had $ — in the bank.

14. Five boys were camping in a tent. Three other boys joined them. There were then — boys camping in the tent.

15. A girl spent 8 cents for some paper and 7 cents for some ribbon. For both she spent — cents.

16. Two 5's are —. One half of 10 is —.

59. Study Exercises.

Study as indicated in Steps A and B, pp. 48, 49.

2	6	5	7	5
5	7	3	8	5
8	3	5	7	5
7	5	5	6	2

To THE TEACHER. Give oral drill on the above combinations. See p. 49.

60. Give the sums of the following:

	a	*b*	*c*	*d*
1.	28 and 7	23 and 5	52 and 5	77 and 6
2.	37 and 6	35 and 5	67 and 8	18 and 7
3.	25 and 2	17 and 6	26 and 7	22 and 5

61. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
5	5	6	7	7	3	5	3	7	6	3	5	7	5
7	5	7	5	3	0	7	5	5	2	7	5	5	6
5	7	5	3	7	7	3	5	6	7	5	5	6	7
6	5	7	5	8	5	7	8	2	5	6	5	7	5
2	6	5	7	5	7	3	5	8	7	5	5	5	7
5	7	3	8	5	6	5	2	7	6	2	5	5	8

62. Oral Drill.

Dictate:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
20	60	80	50	50	30	70	80	90	80	40
50	70	70	30	50	55	67	29	48	58	95

SUBTRACTION — LESSON D

63. 1. *Memorize the following:*

7	13	8	15	10	8	13	7	15
−2	−7	−3	−7	−5	−5	−6	−5	−8
5	6	5	8	5	3	7	2	7

2. Give a number story suggested by each.

3. What number must be added to 7 to make 15?

4. What number must be added to 2 to make 7?

5. What number is one half of 10?

6. Eight is 3 more than —. Two and — are 7.

7. Seven and — are 13. Eight and — are 15.

8. Eight and how many are 15? Six and 7 are —.

9. What number is 5 less than 7?

10. What number is 3 less than 8?

11. Fifteen is 7 more than —. Ten is 5 and —.

12. A girl had 15 cents. She bought a tablet for 8 cents. She had — cents left.

13. There are 13 girls and 7 boys in a class. How many more girls than boys are in the class?

14. There are 8 quarts of water in one pail and 15 quarts of water in another pail. There are — quarts more in the second pail than in the first.

15. Ethel has 8 books. Mary has 5 books. Ethel has — books more than Mary.

16. Harry is 7 years old. His brother is 13 years old. His brother is — years older than Harry.

64. Study Exercises.

7	13	8	15	10	8	13	7	15
−2	−7	−3	−7	−5	−5	−6	−5	−8

Study the above until you can give each answer readily.

65. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*
1.	7385	8507	7385	1573	1385	7553
	−4628	−2752	−1647	−816	−728	−4676
2.	8393	9734	8143	6353	7306	9890
	−1634	−6186	−6098	−2665	−1350	−5397

66. Oral Drill.

Dictate:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
23 *	54	32	33	34	26	53	47 †	27	23	87
52	45	34	75	64	34	47	48	36	59	56

67. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
6	3	5	7	2	7	5	7	4	4	7	6	7	4
3	4	9	8	3	5	2	2	9	7	3	5	2	6
4	7	4	7	4	8	8	8	8	5	9	4	3	8
3	8	3	4	6	5	7	2	5	7	4	8	9	5
6	7	2	8	4	7	5	4	4	3	5	2	2	2
7	3	5	6	9	8	3	4	6	3	5	4	2	8

What is the answer in subtraction called?

* Add: 52, 72, 75. † Add: 48, 88, 95.

68. Oral Problems.

1. Harry is now 13 years old. In how many years will he be 20 years old?

2. When Lottie is 6 years older, she will be 14 years old. How old is Lottie now?

3. After spending $5 a man had $8 left. He had $— at first.

4. A pupil added two numbers. The sum was 15. One of the numbers was 8. The other number was —.

5. A boy earns $13 a month. He spends $6 a month. The boy saves $— each month.

6. There were 13 pupils in a class. Nine of them were boys. There were — girls in the class.

7. A tablet and a pencil cost 9 cents. The tablet cost 5 cents. The pencil cost — cents.

8. Ten boys are how many more than 6 boys?

9. Four is $\frac{1}{2}$ of —. What is $\frac{1}{2}$ of 10 feet?

10. Lucy is 13 years old. Her sister is 6 years younger. Her sister is — years old.

11. A boy paid 15 cents for a ball and bat. The ball cost 5 cents. The cost of the bat was — cents.

12. After working 7 problems a girl had 6 more to work. How many problems had she at first?

13. There are 14 eggs in two nests. In one of the nests there are 8 eggs. In the other there are — eggs.

14. Mary is now 9 years old. In how many years will she be 13 years old?

69. 1. Draw a square; divide it into halves; mark each half.

2. Draw another square; divide it into fourths; mark each fourth.

3. There are — halves in a square. There are — fourths in a square.

4. In the same way divide a square into eighths.

5. There are — eighths in a square.

6. How many fourths make one half? $\frac{1}{2} = \frac{x}{4}$.*

7. Fold a square piece of paper into halves; into fourths; into eighths.

8. Show 6 eighths of a square. $\frac{6}{8} = \frac{x}{4}$.

9. Show one half, one fourth, and one eighth of an oblong.

70. Written Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
575	797	762	659	877	386	557	647	943
687	525	522	255	535	932	786	422	427
575	694	433	762	845	567	562	593	598
356	258	844	523	944	343	555	596	697
642	722	233	476	878	738	876	282	265
965	534	206	657	256	537	757	545	358

71. Written Exercises.

a	*b*	*c*	*d*	*e*
$6100	$5835	$23.34	$90.23	9808 ft.
−$2095	−$628	−$8.76	−$9.84	−4472 ft.

* Supply the value of x.

72. Written Problems.

1. A man bought a horse for $90. He sold it for $60. Find the gain or loss.

2. A man bought a cow for $42. He sold it at a gain of $8. Find the selling price.

3. A man bought a lot for $600. He built a house that cost $1200. He then sold the property for $2300. Find the gain or loss.

4. There are 24 hours in one day. Find the number of hours there are in 2 days.

5. There are 52 weeks in one year. Find the number of weeks there are in 2 years.

6. A man owns three farms of 320 acres each. Find the number of acres in the three farms.

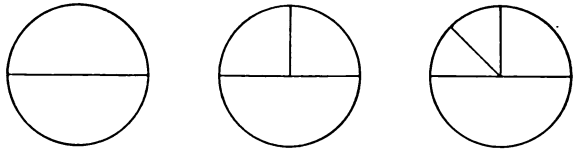
7. A wagon loaded with coal weighs 4280 pounds. The wagon weighs 1920 pounds. What is the weight of the coal?

8. What is the sum of $8.54, $7.86, $4.78, and $6.85?

9. Find the difference between $106.75 and $43.48.

10. A man had $900 in a bank. He drew out $300. How much money did he have left in the bank?

11. A man borrowed $73. He paid back $46. How much did he still owe?



73. 1. A pie is divided equally between two boys. Each boy gets — — of the pie.

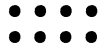
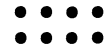
2. Four boys divide a pie equally among themselves. Each boy gets — — of a pie.

3. A certain number of boys divide a pie equally among themselves. Each boy gets one eighth of a pie. There are — boys.

4. $\frac{1}{2}$ of a pie is equal to $\frac{\square}{4}$ of a pie.

5. $\frac{1}{2}$ of a pie and $\frac{1}{4}$ of a pie are $\frac{\square}{4}$ of a pie.

6. $\frac{1}{2} + \frac{1}{4} = \frac{\square}{4}$. $\frac{1}{4} + \frac{1}{2} = \frac{\square}{4}$.

(*a*) (*b*)  (*c*) 

74. Divide group *a* into 2 equal groups; group *b* into 4 equal groups; group *c* into 8 equal groups.

Let each dot stand for a pupil. Fill the following blanks:

1. Four pupils are — — of 8 pupils.
2. Two pupils are — — of 8 pupils.
3. One pupil is — — of 8 pupils.
4. One half of 8 pupils is — pupils.
5. One fourth of 8 pupils is — pupils.
6. One eighth of 8 pupils is — pupils.

ADDITION — LESSON E

75. 1. *Memorize the following:*

7	6	7	9	4
9	6	2	9	8
16	12	9	18	12

2. Give a number story suggested by each.

3. What is the sum of $9 and $7?

4. Two years and 7 years are — years.

5. Twelve yards are 6 yards and — yards.

6. Twelve yards are 8 yards and — yards.

7. One half of 18 miles is — miles.

8. Six quarts and 6 quarts are — quarts.

9. Six is $\frac{1}{2}$ of —. Three is $\frac{1}{2}$ of —.

10. Seven boys and 2 boys are — boys.

11. Six eggs and 6 eggs are — dozen eggs.

12. Eighteen weeks are 9 weeks and — weeks.

13. Two 6's are —. Two 9's are —.

14. Eighteen weeks are — times 9 weeks.

15. Two books are what part of 4 books?

16. What part of 10 days are 5 days?

17. What part of a gallon is one quart?

18. Two quarts are what part of a gallon?

19. Measure 15 feet along the side of the room, using a yard stick. Count the feet by 3's as you measure.

20. Count 18 counters by 2's; by 3's.

76. Study Exercises.

Study as indicated in Steps A and B, pp. 48, 49.

7	6	7	9	4
9	6	2	9	8
8	9	6	9	2
4	9	6	7	7

To THE TEACHER. Give oral drill on the combinations in the above study. See p. 49.

77. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
4	7	4	9	7	6	7	6	9	9	9	9	6	4
9	4	9	7	6	7	4	7	7	1	1	7	9	9
7	9	7	4	7	7	9	7	6	9	9	6	1	7
6	7	4	9	7	6	7	4	7	1	1	9	7	6
7	6	9	7	4	9	8	9	2	9	9	1	1	5
9	6	9	2	8	7	4	9	7	9	7	6	8	1

78. Find the amount of the following bill:

OAKLAND, Cal., June 5, 1905.

Mr. T. H. CRANE,

Bought of HORACE MANN & Co.

2 doz. eggs	@ $.20		40		
2 lb. ham	@ .20		40		
4 lb. butter	@ .25	1	00		
12 lb. sugar	@ .05		60		
4 lb. steak	@ .15		60		
1 cabbage			05		

SUBTRACTION — LESSON E

79. 1. *Memorize the following:*

16	9	18	12	12	16	9	12
−9	−2	−9	−6	−8	−7	−7	−4
7	7	9	6	4	9	2	8

2. Give a number story suggested by each.

3. What must be added to 9 to make 16?

4. A class worked 16 examples in addition and subtraction. Seven of the examples were in subtraction. How many of them were in addition?

5. There are — months in a year.

6. If a boy attends school 8 months each year and has a vacation the remaining months, he has — months' vacation each year.

7. A boy bought a dozen bananas. He ate 4 of them. He had — bananas left.

8. Nine inches and — inches are 18 inches.

9. A farmer had 16 sheep. He sold 7 of them. He had — sheep left.

10. A grocer sold 4 cans of corn from a box containing a dozen cans. There were — cans left in the box.

11. A girl bought a dozen cookies. She gave away all but 4. How many did she give away?

12. On Arbor Day the pupils planted 9 trees. Two of the trees died. How many of them lived?

80. Study Exercises.

16	12	9	12	16	9	18	12
−7	−6	−2	−8	−9	−7	−9	−4

Study the above until you can give the results readily.

81. Written Exercises.

	a	*b*	*c*	*d*	*e*
1.	9626	9828	9222	9826	5622
	−1859	−1859	−6738	−6877	−634
2.	9308	9633	1843	8354	8923
	−2529	−1638	−975	−2866	−5237
3.	9386	8926	9540	6345	2873
	−6499	−4180	−6814	−2378	−916

82. Add: Three hundred seventy dollars and twenty cents, forty-seven dollars and forty-five cents, one hundred four dollars and eighty cents, sixty-eight dollars and forty-seven cents, one dollar and sixty-eight cents, three hundred fifty-two dollars and thirty-seven cents, sixty dollars and eight cents.

83. Oral Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*
77	65	28	43	26	84	96	47	79	57
92	64	34	59	24	64	97	83	24	40

MULTIPLICATION — LESSON A

84. 1. Find the sum of a column of three 2's.

2. Find the sum of a column of three 3's.

3. Two 3's are —. Two 2's are —.

4. Three 2's are —. Three 1's are —.

5. Two 0's are —. Three 0's are —.

6. How many 2's are there in 4? In 6?

7. How many 3's are there in 9? In 6?

8. Two 3's are 6 may be written thus: $\begin{array}{r} 3 \\ \times 2 \\ \hline 6 \end{array}$

9. *Read and memorize:*

3	4	2	2	3	2
×2	×2	×2	×3	×3	×4
6	8	4	6	9	8

10. The sum of 43 and 43 may be found by multiplication, thus:

MODEL: $\begin{array}{r} 43 \\ \times 2 \\ \hline 86 \end{array}$ Two 3's are 6; two 4's are 8. The answer is 86.

85. Multiply:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	23	42	30	41	14	34	24	40
	×2	×2	×2	×2	×2	×2	×2	×2
2.	234	403	312	231	203	123	212	120
	×2	×2	×3	×3	×3	×3	×4	×4

The answer in multiplication is called the **product**.

86. 1. One half of 6 is —. One half of 10 is —.

2. Four is $\frac{1}{2}$ of —. Five is $\frac{1}{2}$ of —.

3. Four pints are — quarts, or — — gallon.

4. Four quarts are — pints. Six pints are — quarts.

5. Two yards are — feet. Nine feet are — yards.

6. Two nickels are — dimes. Two dimes are — cents.

7. One dollar is — cents. One dollar is — dimes. One half-dollar is — cents, or — dimes.

8. Six dimes are — cents. There are — half-dollars in one dollar.

9. There are — quarter-dollars in one dollar.

10. There are — quarter-dollars in one half-dollar.

11. There are — nickels in one quarter-dollar.

12. How many nickels make 20 cents? 30 cents?

13. How many half-dollars make 2 dollars?

87. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
7	9	8	8	3	2	3	3	4	6	5	4	2	8
6	4	2	7	9	5	7	4	6	6	5	4	3	7
5	2	6	9	7	9	9	7	9	6	5	4	3	9
9	4	7	7	4	6	2	9	6	6	5	4	3	9
7	8	5	6	9	6	7	6	7	6	5	4	3	7
4	7	7	2	7	8	5	8	2	6	5	4	3	9
8	9	8	4	6	4	3	5	8	6	5	4	3	4

88. Written Problems.

1. A man bought a bicycle for $45 and a gun for $38. He sold both for $100. Find the amount of gain or loss.

2. A boy earns $10 a month and spends $6. How much will he save in 2 months?

3. What must be added to $75 to make $120?

4. A boy had 65 cents. How much money had he left after paying 25 cents for a ticket to a circus and 10 cents for some popcorn?

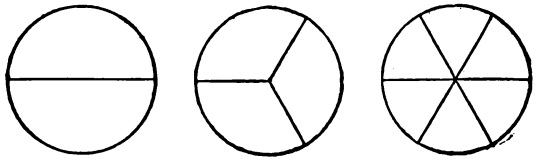
5. A girl read 54 pages of a book on Saturday and 25 pages on Sunday. The book contained 102 pages. How many more pages has she to read to finish the book?

6. Mary picked 16 quarts of berries on Monday, 25 quarts on Tuesday, 17 quarts on Wednesday, and 8 quarts on Thursday. How many quarts did she pick in all?

7. At 30 cents each, how much will 2 readers cost?

89. Written Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
544	737	774	269	643	309	398	232
289	446	336	441	946	721	716	796
364	655	776	269	153	809	406	749
613	737	334	441	975	941	688	959
707	983	776	434	985	969	926	474
829	795	362	239	733	259	686	656



90. 1. One whole is — thirds.

2. One whole is — sixths. One half is — sixths.

3. One third is — sixths. Two thirds are — sixths.

4. One half and one third are — sixths.

5. One half of a pie and one third of a pie are — sixths of a pie.

6. Two thirds and one half are — sixths.

7. One half of one third is — sixths.

8. Which is the larger, one half or one third? One third or one sixth? One half or three sixths? One half or two sixths? Two thirds or three sixths?

9. One half and one fourth are — fourths.

10. The ratio of 2 to 4 is — —; of $\frac{1}{4}$ to $\frac{1}{2}$ is — —; of $\frac{1}{6}$ to $\frac{1}{3}$ is — —.

11. The ratio of 4 to 2 is —; of $\frac{1}{3}$ to $\frac{1}{6}$ is —; of $\frac{1}{2}$ to $\frac{1}{4}$ is —.

91. *Memorize:*

1. One half and one fourth are three fourths.

2. One half and one third are five sixths.

ADDITION — LESSON F

92. 1. *Memorize the following:*

7	3	5	9	9
7	4	7	2	1
14	7	12	11	10

2. Give a number story suggested by each.

3. What is the sum of $7 and $7?

4. How many days are there in 2 weeks?

5. Two 7's are —. One half of 14 is —.

6. A boy spent $4 for a suit of clothes and $3 for a pair of shoes. He spent $— in all.

7. A boy had 10 words to spell. He missed one word. He spelled — words correctly.

8. Twelve months are 7 months and — months.

9. How much more is the sum of 7 and 7 than the sum of 7 and 5?

10. The sum of 9 and 2 is one more than the sum of 9 and —.

11. If one sheep costs $7, what will be the cost of 2 sheep?

12. If a boy had 12 oranges and gave away 5 of them, he would have — oranges left.

13. Four days and — days make one week.

14. A ruler 12 inches long is cut into 2 pieces. If one piece is 7 inches long, the other piece is — inches long.

93. Study Exercises.

Study as indicated in Steps A and B, pp. 48, 49.

7	3	5	9	9
7	4	7	2	1
7	2	7	1	4
5	9	7	9	3

To THE TEACHER. Give oral drill. See p. 49.

94. Oral Exercises.

Add as in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
5	7	9	3	9	7	9	9	5	9	4
9	7	9	4	9	7	5	0	3	9	9
9	9	5	9	7	9	3	9	7	5	9
5	9	3	0	5	9	4	7	3	3	5
3	5	7	9	9	0	9	5	7	4	4
7	3	4	5	9	7	2	9	3	1	0
7	4	3	7	2	5	9	1	4	9	3

DIVISION — LESSON A

95. 1. Two 2's are —. Two 3's are —. Three 2's are —. Three 3's are —. Four 2's are —. Two 4's are —.

2. The number of 2's in 8 may be shown thus: $2\overline{)8}^{4}$

3. *Read and memorize:*

$2\overline{)6}^{3}$	$2\overline{)4}^{2}$	$3\overline{)6}^{2}$	$2\overline{)8}^{4}$	$3\overline{)9}^{3}$	$4\overline{)8}^{2}$

The answer in division is called the **quotient.**

SUBTRACTION — LESSON F

96. 1. *Memorize the following:*

12	14	7	11	10	12	7	11	10
−7	−7	−3	−2	−9	−5	−4	−9	−1
5	7	4	9	1	7	3	2	9

2. Give a number story suggested by each.

3. A girl picked 7 boxes of cherries. She sold all but 3 boxes. How many boxes did she sell?

4. Some boys bought a dozen lemons. They used 7 of them in making lemonade. How many lemons had they left?

5. A line 7 inches long is — inches shorter than a foot rule.

6. There are — days in 2 weeks. Two 7's are —.

7. How many less than 12 apples are 7 apples?

8. How many less than 11 weeks are 9 weeks?

9. Seven days are how many more than 3 days?

10. Fourteen inches are how many more than 7 inches?

11. How much longer than the sum of 4 inches and 3 inches is one foot?

12. How much longer than the sum of 2 inches and 9 inches is one foot?

13. How many hours are there from 5 o'clock to 12 o'clock?

97. Study Exercises.

12	7	11	10	14	12	11	7	10
−7	−3	−9	−1	−7	−5	−2	−4	−9

Study the above until you can give the results without hesitation.

98. Written Exercises.

	a	*b*	*c*	*d*	*e*
1.	7474	7272	7242	2010	7111
	−3737	−2727	−3465	−1999	−3182

	a	*b*	*c*	*d*	*e*
2.	8401	9123	9445	7452	3572
	−2749	−3145	−5677	−4567	−816

99. Study Exercises.

$2\overline{)6}$ $2\overline{)4}$ $3\overline{)6}$ $2\overline{)8}$ $3\overline{)9}$ $4\overline{)8}$

Study the above until you can give the answers readily.

The number of 2's there are in 64 may be found thus: $2\overline{)64}$ 32 There are three 2's in 6, and two 2's in 4. There are thirty-two 2's in 64.

100. Divide:

	a	*b*	*c*	*d*	*e*
1.	$2\overline{)46}$	$2\overline{)62}$	$2\overline{)80}$	$2\overline{)64}$	$3\overline{)63}$
2.	$2\overline{)6420}$	$2\overline{)2604}$	$2\overline{)4026}$	$2\overline{)4602}$	$2\overline{)2064}$
3.	$3\overline{)3690}$	$3\overline{)6309}$	$3\overline{)9603}$	$3\overline{)3096}$	$3\overline{)6309}$

101. Oral Problems.

1. How many pints are there in 3 quarts?

2. How many yards are there in 9 feet?

3. Three dollars are how many half-dollars?

4. Eight pints are how many quarts?

5. Two yards are — feet. Two gallons are — quarts.

6. A half-dollar is — dimes; — nickels; — cents.

7. Eighteen cents are — dime and — cents.

8. Six quarts are — gallon and — quarts.

9. The number of 2 cents there are in 6 cents may be shown thus: $2¢\overline{)6¢}\ 3$

10. Read and give quotients:

$2¢\overline{)4¢}$ $3¢\overline{)6¢}$ $4¢\overline{)8¢}$ $2¢\overline{)8¢}$ $\$3\overline{)\$9}$ $\$2\overline{)\$6}$

11. Read and divide:

$3\text{ ft.}\overline{)66\text{ ft.}}$ $\$4\overline{)\$48}$ $\$2\overline{)\$80}$ $2\text{ in.}\overline{)60\text{ in.}}$

102. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
4	9	7	6	3	2	8	8	7	4	5	8	6	7
6	2	9	8	8	6	6	7	4	9	6	4	4	8
7	6	9	7	7	9	2	8	7	6	8	5	6	7
6	4	8	8	6	7	8	6	4	7	6	9	8	9
8	6	7	7	8	4	7	7	6	1	7	2	6	7
5	7	2	8	7	4	3	7	3	4	4	6	9	9
7	9	5	5	7	8	4	2	5	5	9	6	9	3

103. 1. We can find one half of 8 books by separating the books into — equal groups.

2. Show one half of 6 books; of 8 books.

3. One half of 8 books is — books. This may be shown thus: $\begin{array}{r} 4 \text{ books} \\ 2\overline{)8 \text{ books}} \end{array}$

4. Read and give quotients:

$2\overline{)4 \text{ books}}$ $3\overline{)6 \text{ books}}$ $2\overline{)\$8}$ $2\overline{)\$6}$ $3\overline{)9 \text{ ft.}}$ $4\overline{)\$8}$

5. Read and divide:

a	*b*	*c*	*d*	*e*
$2\overline{)\$286}$	$2\overline{)\$402}$	$2\overline{)\$840}$	$2\overline{)608 \text{ ft.}}$	$3\overline{)360 \text{ da.}}$

6. Find $\frac{1}{2}$ of \$460. Find $\frac{1}{3}$ of \$390.

7. Find $\frac{1}{4}$ of \$408. Find $\frac{1}{2}$ of 680 pounds.

8. A man had \$84. He spent one half of it for a wagon. How much did the wagon cost him?

104. Written Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
547	923	897	246	875	141	646	574
656	759	265	463	336	676	246	306
878	386	682	675	474	519	346	759
697	779	376	978	385	434	346	686
874	525	449	926	673	608	346	853
382	467	772	437	469	187	346	418
492	487	839	299	843	515	346	707

105. Written Problems.

1. After selling 47 sheep a farmer had left 38 sheep. How many sheep had he at first?

2. A farmer had 32 cows. He bought 29 more cows. How many cows had he then?

3. Of a school of 436 pupils, 169 are boys. How many girls are there in the school?

4. Find the cost of 3 cows at $ 23 each.

5. There are 55 pupils in the First Grade, 46 pupils in the Second, and 37 pupils in the Third. How many pupils are there in the three grades?

6. There are 35 girls and 18 boys in a school. How many more girls than boys are there in the school?

7. A boy had 48 marbles. He sold one fourth of them. How many did he sell? How many marbles did he have left?

8. A grocer bought flour at 89 cents a sack and sold it at $ 1.00 a sack. How much did he make on each sack?

9. A horse that cost $ 86 was sold at a gain of $ 18. Find the selling price.

106. Solve:

a	*b*	*c*	*d*	*e*	*f*
$ 234	$ 403	$ 320	432 ft.	201 ft.	233 yd.
× 2	× 2	× 3	× 2	× 4	× 3
$	$	$	ft.	ft.	yd.

(*a*) (*b*) (*c*)

107. Divide group *a* into two equal parts; group *b* into three equal parts; group *c* into six equal parts. Let each dot represent a pupil.

1. — pupils are $\frac{1}{2}$ of 6 pupils.
2. — pupils are $\frac{1}{3}$ of 6 pupils.
3. — pupil is $\frac{1}{6}$ of 6 pupils.
4. Six pupils are — times 3 pupils.
5. Six pupils are — times 2 pupils.
6. How many 2 pupils are there in 6 pupils?
7. How many 3 pupils are there in 6 pupils?
8. Six pupils are how many times 2 pupils?
9. Six pupils are how many times 3 pupils?
10. One half of 6 pupils is — more pupil than one third of 6 pupils.
11. The ratio of 3 pupils to 6 pupils is — —; of 2 pupils to 6 pupils is — —.
12. The ratio of 6 pupils to 3 pupils is —; of 6 pupils to 2 pupils is —; of 6 pupils to one pupil is —.
13. The difference between $\frac{1}{2}$ of 6 pupils and $\frac{1}{3}$ of 6 pupils is — pupil.

108. Add:

a	*b*	*c*	*d*	*e*
$2\frac{1}{4}$	$5\frac{1}{3}$	$9\frac{1}{8}$	$2\frac{1}{4}$	$4\frac{1}{6}$
$3\frac{1}{2}$	$4\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{1}{8}$	$9\frac{1}{3}$

ADDITION — LESSON G

109. 1. *Memorize the following:*

8	9	6	7	9
8	6	5	1	8
16	15	11	8	17

2. Give a number story suggested by each.

3. What is the sum of 9 and 8?

4. What is the sum of two 8's?

5. A boy has 9 marbles in one pocket, and 6 in the other. How many marbles has he in both pockets?

6. Seventeen is — more than 8.

7. Two 8's are 16. One half of 16 is —.

8. What is the ratio of 16 to 8? Of 8 to 16?

9. Fred has 6 pigeons. Walter has 5 pigeons more than Fred. How many pigeons has Walter?

10. A piece 5 ft. long was sawed from a board 11 ft. long. How long was the part that remained?

11. A post 8 ft. long is 1 ft. below ground. How long is the part above ground?

12. A boy delivers 6 quarts of milk each morning and 5 quarts each evening. How many quarts does he deliver each day?

13. From a board 16 ft. long a piece 8 ft. long is cut. How long is the part remaining?

110. Study Exercises.

Study as indicated in Steps A and B, pp. 48, 49.

8	9	6	7	9
8	6	5	1	8
8	1	8	5	6
9	7	8	6	9

To THE TEACHER. Dictate for oral addition the combinations studied in the above exercises. See p. 49.

111. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
9	1	6	6	5	6	1	8	9	8	9	9	9	5
7	9	9	9	8	9	9	1	7	7	8	1	1	8
6	7	8	8	7	8	7	9	5	5	1	9	9	7
9	6	1	7	6	1	5	7	1	8	9	1	1	5
8	9	9	5	6	8	8	6	6	7	0	9	6	8
8	6	8	6	9	9	8	5	9	1	8	8	9	8

112. Write in a column and add:

1. $38.67, $.88, $67.46, $.89, $69.34.
2. $85.89, $.70, $8.05, $67.96, $9.77.

113. Write and solve:

1. $24.93 − $8.15.
2. $104.50 − $7.15.
3. $70.42 − $5.79.
4. $30.00 − $6.44.
5. $90 − $17.50.
6. $85.46 − $18.

SUBTRACTION — LESSON G

114. 1. *Memorize the following:*

15	11	17	8	16	15	11	17	8
−6	−5	−8	−7	−8	−9	−6	−9	−1
9	6	9	1	8	6	5	8	7

2. Give a number story suggested by each.

3. A man earns $15 a week and spends $6 a week. He saves $— each week.

4. A post 11 feet long stands in a hole 5 feet deep. How much of the post is above ground?

5. A milkman sold 8 quarts of milk from a can containing 17 quarts. How many quarts remained in the can?

6. A grocer sold 15 lb. of sugar in two packages. If one of the packages weighed 9 lb., how much did the other weigh?

7. Mary is 8 years old and her sister is 17 years old. Mary is — years younger than her sister.

8. Ethel went to visit Lottie on the ninth of June and stayed until the fifteenth of June. How long was her visit?

115. Multiply:

a	*b*	*c*	*d*	*e*	*f*
423	3132	2012	4023	1022	3012
2	3	4	2	4	3

116. Study Exercises.

15	11	8	17	16	15	8	11	17
−9	−5	−7	−8	−8	−6	−1	−6	−9

Study the above until you can give the results without hesitation.

117. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*
1.	8515	8717	1755	8655	1556	1777
	−849	−6859	−886	−7759	−858	−878
2.	1715	5365	9537	9608	7474	1423
	−849	−1578	−2769	−6809	−1837	−348
3.	9847	6328	8456	9167	3135	8636
	−2038	−1835	−3778	−5569	−439	−2747

MULTIPLICATION — LESSON B

118. Show by addition and multiplication:

1. The sum of two 5's; of four 3's; of three 4's.
2. The sum of five 2's; of two 6's; of six 2's.

119. *Read and memorize:*

1.	5	4	2	3	6	3	2	5
	×2	×3	×5	×5	×2	×4	×6	×3
	10	12	10	15	12	12	12	15

2. What is the answer in multiplication called?

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120. Study Exercises.

5	4	2	5	6	3	2	3
×2	×3	×5	×3	×2	×4	×6	×5

Study the above until you can give the results without hesitation.

Give the products in the above exercises from right to left, adding 1, 2, and 3 to each product, thus: 15, 16; 12, 13; 12, 13; etc.

121. Written Exercises.

MODEL for Exercise *a*: 465 × 2 = 930. Carry in multiplication as in addition.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	465	365	260	345	250	123	203	332
	×2	×2	×2	×3	×3	×4	×4	×4
2.	210	122	201	231	102	405	604	213
	×5	×5	×6	×5	×6	×3	×2	×4
3.	345	234	222	320	132	305	403	413
	×2	×3	×6	×4	×5	×2	×2	×3

122. Oral Exercises.

Add:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
70	69	75	53	58	43	36	67	25
70	61	86	45	64	59	94	83	76

DIVISION — LESSON B

123. 1. Count by 3's to 18; by 2's to 24; by 4's to 20; by 5's to 30.

2. Arrange 6 books to show that 2 books are $\frac{1}{3}$ of 6 books.

3. One third of 6 books is — books. Two thirds of 6 books are — books.

4. Draw oblongs to represent 9 books. One third of 9 books is — books. Two thirds of 9 books are — books.

5. Show $\frac{1}{4}$ of 12 squares. Show $\frac{3}{4}$ of 12 squares.

6. Three fourths of 12 squares are — squares.

7. Show $\frac{1}{2}$ of 12 circles. Show $\frac{1}{6}$ of 12 circles.

124. *Read and memorize:*

4	3	3	5	2	5	6	2
$3\overline{)12}$	$5\overline{)15}$	$4\overline{)12}$	$3\overline{)15}$	$6\overline{)12}$	$2\overline{)10}$	$2\overline{)12}$	$5\overline{)10}$

125. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
3	6	4	5	4	7	3	9	7	5	9	8	4	3
7	8	7	6	6	6	8	7	8	7	6	9	8	5
9	7	9	8	2	8	2	8	2	6	7	1	9	3
7	8	8	5	3	7	7	9	5	9	6	9	7	8
5	6	3	6	8	9	4	7	6	9	9	1	4	7
7	5	6	8	9	7	6	4	8	7	5	9	6	6
9	8	7	9	6	2	8	9	4	5	6	8	6	4

126. Study Exercises.

$3\overline{)12}$ $5\overline{)15}$ $4\overline{)12}$ $3\overline{)15}$ $6\overline{)12}$ $2\overline{)10}$ $2\overline{)12}$ $5\overline{)10}$

Study the above until you can give the quotients without hesitation.

1. $2\overline{)12}$ This means: *How many 2's are there in* 12? Or, *What is* $\frac{1}{2}$ *of* 12? The answer is —.

2. $2\overline{)\$12}$ This means: *What is* $\frac{1}{2}$ *of* \$12? The answer is —.

3. $\$2\overline{)\$12}$ This means: *How many* \$2 *are there in* \$12? The answer is —.

127. Read and find quotients:

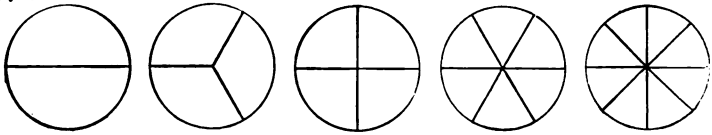
	a	*b*	*c*	*d*	*e*
1.	$2\overline{)2648}$	$4\overline{)8048}$	$4\overline{)1248}$	$2\overline{)1046}$	$\$3\overline{)\$1296}$
2.	$6\overline{)1206}$	$5\overline{)1050}$	$5\overline{)1005}$	$4\overline{)1208}$	$3\overline{)6012 \text{ ft.}}$

128. Written Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
799	999	788	899	949	997	978	889	998
617	899	476	937	994	556	292	789	871
696	991	768	946	794	958	926	875	358
949	946	489	479	893	779	374	965	663
978	999	987	558	794	497	898	899	994
538	426	259	538	369	838	366	429	439

129. Solve:

a	*b*	*c*	*d*
\$84.93	\$43.21	\$87.53	\$97.34
−\$17.16	−\$14.52	−\$48.79	−\$17.36



130. Show the truth of each statement by folding or cutting paper.

1. $\frac{1}{6}$ of a pie is more than $\frac{1}{8}$ of a pie.
2. $\frac{1}{8}$ of a pie is less than $\frac{1}{2}$ of a pie.
3. $\frac{1}{3}$ of a pie $+\frac{1}{6}$ of a pie is the same as $\frac{1}{2}$ of a pie.
4. $\frac{1}{4}$ of a pie $+\frac{1}{8}$ of a pie is more than $\frac{1}{3}$ of a pie.
5. $\frac{2}{3}$ of a pie $+\frac{1}{6}$ of a pie is $\frac{1}{6}$ of a pie less than a whole pie.
6. $\frac{2}{3}$ of a pie $+\frac{1}{2}$ of a pie is $\frac{1}{6}$ of a pie more than a whole pie.
7. $\frac{1}{4}$ of a pie $+\frac{1}{2}$ of a pie is $\frac{1}{4}$ of a pie less than a whole pie.
8. $\frac{3}{8}$ of a pie is $\frac{1}{8}$ of a pie less than $\frac{1}{2}$ of a pie.
9. $\frac{3}{8}$ of a pie $+\frac{1}{4}$ of a pie is $\frac{1}{8}$ of a pie more than $\frac{1}{2}$ of a pie.
10. If we cut $\frac{1}{4}$ of a pie from $\frac{3}{8}$ of a pie, there will remain $\frac{1}{8}$ of a pie.

131. *Memorize:*

a	*b*	*c*	*d*	*e*
$\frac{1}{2}$	$\frac{3}{8}$	$\frac{3}{8}$	$\frac{2}{3}$	$\frac{2}{3}$
$-\frac{1}{4}$	$-\frac{1}{4}$	$+\frac{1}{4}$	$+\frac{1}{2}$	$+\frac{1}{6}$
$\frac{1}{4}$	$\frac{1}{8}$	$\frac{5}{8}$	$\frac{7}{6}=1\frac{1}{6}$	$\frac{5}{6}$

ADDITION—LESSON H

132. 1. *Memorize the following:*

1	5	7	2	8
8	9	4	1	3
9	14	11	3	11

2. Give a number story suggested by each.

3. What two combinations in this lesson give 11 as a sum?

4. What must be added to $5 to make $14?

5. Name another combination whose sum is 14.

6. The sum of 9 and 9 is 18; of 9 and 8 is 17; of 9 and 7 is 16. When a number is added to 9, the sum ends in a figure one less than that added to 9.

7. A girl has 4 books of poems and 7 story books. How many books has she in all?

133. Oral Exercises.

The sign = between two quantities shows that they are equal in amount.

$4+5=9$. This means that the sum of 4 and 5 is equal to 9.

$4+5=6+3$. This means that the sum of 4 and 5 is equal to the sum of 6 and 3.

134. Supply the number that should stand in place of x.

1. $7+4=3+x$.
2. $9+5=8+x$.
3. $9+7=8+x$.
4. $6+5=4+x$.
5. $7+8=6+x$.
6. $5+9=7+x$.

135. Study Exercises.

Study as indicated in Steps A and B, pp. 48, 49.

1	5	7	2	8
8	9	4	1	3
3	1	9	4	8
8	2	5	7	1

To THE TEACHER. Dictate the combinations involved in the above study. See p. 49.

136. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*
8	7	5	7	8	2	8	8	9	8	8	2	2
2	5	8	5	2	7	8	7	1	2	7	8	7
7	8	8	8	8	5	2	5	9	8	5	2	9
5	7	2	8	2	8	7	8	1	2	8	8	1
1	5	8	2	7	3	9	8	9	3	4	1	5
8	9	3	1	4	8	5	3	5	8	7	2	9

137. *Drill columns.* A drill column is one in which a combination occurs several times. To make a drill column for 8 and 7: Write the combination at the foot of the column. The sum is 15. Place in the column a number that will increase the sum to either 18 or 17. This number is either 3 or 2. Either can be used. If 2 is taken, the sum is increased to 17. Then place 8 in the column. The sum is 25. Again add either 3 or 2, and continue as above.

8
2
7
3
8
2
7
8

Write a drill column for 6 and 7; for 9 and 6; for 8 and 5; for 9 and 7.

SUBTRACTION — LESSON H

138. 1. *Memorize the following:*

9	14	11	9	3	11	14	11	11	3
−1	−5	−4	−8	−2	−8	−9	−7	−3	−1
8	9	7	1	1	3	5	4	8	2

2. Give a number story suggested by each.

3. A board 11 ft. long will make two shelves, one 4 ft. long and the other — ft. long.

4. How many days are there from April 3 to April 11?

5. There were 11 marbles in a ring. Frank shot 3 of them out of the ring. There were — marbles left in the ring.

6. A farmer sold 14 sacks of grain. Five were wheat, and the rest were oats. He sold — sacks of oats.

Draw a diagram to show the places mentioned in each of the following problems:

7. Harry's home is 1 mile north of the schoolhouse, and Willie's home is 2 miles south of the schoolhouse. How far apart do they live?

8. Mary's home is 4 blocks east of the schoolhouse, and Edna's home is 7 blocks west of the schoolhouse. How far apart do they live?

9. Fred lives 9 miles west of the city, and James lives 14 miles west of the city. How far apart do they live?

139. Study Exercises.

9	14	11	9	3	11	14	11	11	3
−1	−5	−4	−8	−2	−8	−9	−7	−3	−1

Study the above until you can give the results without hesitation.

140. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*
1.	3841	9341	3114	3411	9141	9319
	−1687	−944	−275	−2463	−7398	−1041
2.	6056	9327	2526	8436	5143	9357
	−3968	−8469	−783	−4759	−2436	−6468
3.	9418	9473	9365	9785	3368	7991
	−4476	−6627	−7467	−6489	−2579	−4898

141. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
6	8	9	7	5	9	9	4	3	9	5	4	2	9
9	9	5	9	6	5	7	5	5	5	4	3	8	7
4	1	5	1	4	5	8	6	5	5	6	7	2	3
6	6	7	4	8	6	7	2	8	9	7	9	8	9
5	4	3	6	2	4	3	7	2	1	3	1	2	1
8	9	5	4	6	5	7	3	8	5	7	9	8	7
9	6	7	9	8	6	7	8	5	9	4	3	8	9

142. Oral Problems.

1. One dollar is — cents; — nickels; — dimes; — half-dollars.

2. A half-dollar is — cents; — nickels; — dimes; — quarter-dollars.

3. A quarter-dollar is — cents; — nickels; 2 dimes and — cents.

4. If Edna buys a box of berries for 15 cents and gives the clerk a 25-cent piece, how much change will she receive?

5. Mabel buys 35 cents' worth of sugar and gives the clerk a half-dollar. The clerk counts the change as he gives it to Mabel. He begins with the cost of the sugar and says, 35 and 5 are 40, and 10 are 50, as he gives her a nickel and a dime.

6. Ethel bought 30 cents' worth of ribbon and handed the dealer a half-dollar. Count the change.

143. Have the pupils take turns at "keeping store." Supply them with paper coins (or better, with real coins), and have them make purchases and count the change.

Make change for:

1. 40 cents out of $1.00.
2. 60 cents out of $1.00.
3. $1.25 out of $5.00.
4. $2.25 out of $5.00.
5. 30 cents out of $1.00.
6. 15 cents out of $5.00.
7. $3.50 out of $10.00.
8. $4.25 out of $5.00.

144. Oral Problems.

1. A boy paid 50¢ for a baseball and 30¢ for a glove. How much did he pay for both?

2. Harry and James picked two boxes of apples and sold them at 60¢ a box. How much did they get for both boxes?

3. If there are 24 boys and 32 girls in the school, how many children are there in the school?

4. Six boys bought a dozen bananas and shared them equally. How many bananas did each boy get?

5. A farmer had 60 sheep. How many did he have after selling 20 sheep?

6. It is 2 miles from Arthur's home to his aunt's. On Saturday Arthur made two trips on his bicycle to his aunt's and return. How many miles did he ride?

7. If it takes 3 yards of cloth to make one apron, how many aprons can be made from 12 yards?

8. If oranges sell at 20¢ a dozen, how many dozen can be bought for 60¢?

9. What is the cost of 3 pounds of coffee at 30¢ a pound?

10. What is the cost of five 2-cent stamps?

11. At 60 cents a yard, how much will $\frac{1}{2}$ yd. of cloth cost?

12. How many gallons are there in 12 quarts?

145. Written Exercises.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
474	938	546	218	917	645	539	462
907	794	477	827	129	387	958	547
836	672	259	388	451	719	867	243
593	866	998	916	679	693	926	589
688	978	738	193	832	568	775	362
966	489	999	778	178	686	944	318
389	749	823	143	819	617	233	759

146. Written Problems.

1. Harry is saving his money to buy a bicycle that will cost $45. He has saved $38. How much more must he save before he can pay for the bicycle?

2. Four boys went fishing. They paid 25¢ for the use of a boat, 15¢ for bait, 35¢ for some lines, and 45¢ for lunch. Find the whole cost of the trip. Find each boy's share of the expenses.

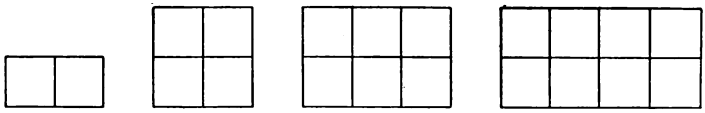
3. A man bought a horse for $95. For what must he sell the horse to gain $25?

4. A boy had 60 marbles and sold one third of them. How many marbles did he sell? How many had he left?

5. A farmer sold three cows for the following sums: $28, $36, and $40. How much did he get for them?

6. A farmer sold 4 cows at $32 each. How much did he get for them?

SURFACES



A *B* *C* *D*

147. 1. The surface of Fig. *A* is — of the surface of Fig. *B*.

2. The surface of Fig. *A* is — of the surface of Fig. *C*.

3. The surface of Fig. *B* is — of the surface of Fig. *C*.

4. The surface of Fig. *A* is — of the surface of Fig. *D*.

5. The surface of Fig. *B* is — of the surface of Fig. *D*.

6. The surface of Fig. *B* is — times the surface of Fig. *A*.

7. The surface of Fig. *D* is four times the surface of Fig. —.

8. The surface of Fig. *D* is two times the surface of Fig. —.

9. The ratio of Fig. *A* to Fig. *B* is —.

10. The ratio of Fig. *C* to Fig. *A* is —.

11. What part of the surface of Fig. *C* is equal to the surface of Fig. *A*?

12. Three times Fig. *A* is equal to Fig. —.

13. If Fig. *A* represents 2 square inches, Fig. *B* will represent — square inches.

148. 1. Your desk top has length. Has it width?

2. Anything that has length and width has **area.**

3. Have the sides of this room area?

4. Has a book cover area?

5. A square inch is a square whose sides are each one inch. Draw a square inch.

6. A square inch is the smallest unit of area.

7. Name a unit of area larger than the square inch.

8. Draw an oblong 3 in. long and 1 in. wide. Divide the oblong into square inches. How many square inches are there in the oblong?

9. Draw an oblong 3 in. long and 2 in. wide. Divide it into square inches. How many square inches are there in the oblong? What is the area of the oblong? How many 3 sq. in. are there in the oblong?

10. In Problem 9, two square inches are what part of the oblong? Three square inches are what part of the oblong?

11. Draw an oblong 4 in. long and 3 in. wide. How many 4 sq. in. can be made of the oblong? What is the area of the oblong?

12. Draw an oblong 4 in. long and 2 in. wide. How many 4 sq. in. can be made of this oblong? What is the area of the oblong?

13. Draw an oblong 4 in. long and wide enough to contain 4 sq. in. What is its area?

149. 1. How long is this book?

2. The unit of length used to measure short distances is the inch.

3. How long is this room?

The foot is the unit of measure next in length to the inch. We use the unit 1 foot in measuring the length of a room.

4. What is the unit of length in measuring cloth?

5. The rod and the mile are each units of length. These are used in measuring long distances.

6. Study the inch, the foot, and the yard. See Lesson VII, p. 21.

7. Draw a line 12 inches long. Divide the line into inches. The unit of measure of the line is —.

8. Draw a line 3 feet long.

9. Three feet are 1 yard.

10. One foot is — third of a yard.

11. In 5 feet there is — yard and — feet.

12. What part of one foot is one inch?

13. Six inches are — twelfths of 12 inches.

14. Divide 12 inches into 3 inches.

15. In 12 inches there are — 3 inches.

16. Divide 12 inches into 4 inches.

17. In 12 inches there are — 4 inches.

18. *Memorize:*

Twelve inches are one foot,
Three feet are one yard.

CHAPTER IV

MULTIPLICATION AND DIVISION

SIMPLE FRACTIONS, COMPOUND NUMBERS, REVIEWS

MULTIPLICATION — LESSON C

150. Oral Problems.*

1. How much will 2 chairs cost at $ 4 each?

MODEL for oral recitation: Since 1 chair costs $ 4, 2 chairs will cost 2 times $ 4, or $ 8.

MODEL for written recitation:

$ 4, cost of 1 chair.
× 2
$ 8, cost of 2 chairs.

2. How much will 2 clocks cost at $ 6 each?

3. At $ 3 a pair, how much will 2 pairs of shoes cost?

4. How much will 2 tables cost at $ 5 each?

5. At 5¢ each, how much will 2 oranges cost?

6. How much will 3 hats cost at $ 4 each?

7. There are 4 quarts in a gallon. How many quarts are there in 2 gallons?

* Drill should be given upon these and similar problems until the pupils are familiar with the language forms used in the analysis. The written form should be taken up after the oral form has been mastered. Apply these forms to similar problems on the succeeding pages of the text.

151. Oral Problems.*

1. If 2 chairs cost \$6, what is the cost of 1 chair?

MODEL for oral recitation: If 2 chairs cost \$6, 1 chair will cost one half of \$6, or \$3.

MODEL for written recitation:

\$3, cost of 1 chair.
2)\$6, cost of 2 chairs.

2. If 2 stoves cost \$10, what is the cost of 1 stove?

3. If 2 tables cost \$8, what is the cost of 1 table?

4. If 2 tablets cost 12¢, what is the cost of 1 tablet?

5. If 3 boxes of berries cost 15¢, what is the cost of 1 box?

6. If 3 pencils cost 6¢, what is the cost of 1 pencil?

7. If 3 hats cost \$9, what is the cost of 1 hat?

8. If 4 pairs of shoes cost \$12, what is the cost of 1 pair?

9. If 1 yd. of cloth costs 12¢, what is the cost of $\frac{1}{2}$ yd.?

10. If 1 yd. of ribbon costs 8¢, what is the cost of $\frac{1}{2}$ yard?

11. What is the cost of $\frac{1}{3}$ yd. of cloth at 15¢ a yard?

12. What is the cost of $\frac{1}{2}$ doz. eggs at 12¢ a dozen?

13. If 4 chairs cost \$12, what is the cost of 1 chair?

14. What is the cost of 1 stove at the rate of 2 stoves for \$12?

* See note, p. 115.

152. Oral Exercises.

1. Add a column of four 4's; of five 3's.
2. Count by 4's to 16; by 3's to 15.
3. Add a column of seven 2's; of eight 2's.
4. Count by 2's to 14; by 2's to 16.
5. Four 4's are —; five 3's are —; three 5's are —.
6. Seven 2's are —; two 7's are —; eight 2's are —.
7. In 16 there are — 4's. There are — 2's in 16.
8. How many nickels are there in 15 cents?
9. *Memorize:*

4	8	7	2	2
×4	×2	×2	×8	×7
16	16	14	16	14

10. 7 is read two 7's are 14. It may also be read, two times 7 is 14.

11. A boy bought 3 oranges at 5¢ each. How much did he pay for all?

12. At 3¢ each, how much will 5 pencils cost?

13. Frank has $4 and Arthur has four times as much money. How much money has Arthur?

14. At $2 each, how much will 8 hats cost?

15. There are 7 days in one week. How many days are there in 2 weeks?

16. Ethel worked 8 problems and Edna worked twice as many. How many problems did Edna work?

153. Study Exercises.

4	8	7	2	2
×4	×2	×2	×8	×7

Study the above exercises until you can give the products without hesitation.

Give the products from right to left, adding 3 to each product, thus: 14, 17; 16, 19; etc.

154. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	2034	3140	4213	1324	4321	3400	2341
	×4	×4	×4	×4	×4	×4	×4
2.	3023	3333	2323	2030	1302	3032	3021
	×5	×5	×5	×5	×5	×5	×5
3.	1212	2021	2222	2012	1220	2222	2121
	×6	×6	×7	×7	×7	×8	×8

4. Multiply 457 by 20.

MODEL: 457 ×20 = 9140. 0 times 457 is 0. Write 0 under the 0 in the multiplier. 2 times 7 is 14. Write the 4 under the 2 in the multiplier, and continue.

	a	*b*	*c*	*d*	*e*	*f*	*g*
5.	3457	5678	6785	3467	4576	6587	3478
	×20	×20	×20	×20	×20	×20	×20
6.	3425	5243	4035	2304	4230	3040	2130
	×30	×30	×30	×40	×40	×40	×50

155. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*
7	8	8	7	9	8	7	6	9	8	7	4	2
3	7	2	3	1	2	3	4	1	2	3	6	8
6	5	8	8	4	4	5	5	3	8	7	4	2
4	8	1	2	6	6	5	5	7	2	5	3	8
7	7	8	7	9	8	7	6	9	6	5	7	2
3	5	2	3	1	2	3	4	1	4	3	6	8
6	5	8	8	4	8	5	5	3	6	5	3	8
7	8	9	7	9	4	7	6	9	8	6	5	4

156. 1. Show by objects how many 2 books there are in 3 books; in 5 books; in 7 books.

2. Show how many 3 boys there are in 7 boys.

3. In 7 there are — 2's and — remainder.

4. How many 2's are there in 70?

MODEL: $2\overline{)70}$. 35. In 7 there are three 2's and 1 remainder. Write 3 above the 7, and think the 1 before 0. In 10 there are 5 twos. Write 5 above the 0. There are 35 twos in 70. One half of 70 is —.

157. Divide:

	a	*b*	*c*	*d*	*e*	*f*
1.	$2\overline{)70}$	$2\overline{)50}$	$2\overline{)92}$	$2\overline{)76}$	$2\overline{)34}$	$3\overline{)42}$
2.	$3\overline{)102}$	$3\overline{)105}$	$3\overline{)300}$	$3\overline{)420}$	$3\overline{)720}$	$3\overline{)672}$.
3.	$2\overline{)530}$	$2\overline{)302}$	$2\overline{)710}$	$2\overline{)930}$	$3\overline{)1032}$	$3\overline{)7032}$.

DIVISION — LESSON C

158. 1. In \$4 there are — \$2. In \$5 there are — \$2 and \$ — remainder.

2. What is $\frac{1}{2}$ of 5? What is $\frac{1}{2}$ of 11?

3. To find one half of a number, divide it by —.

4. Find $\frac{1}{2}$ of 9.

MODEL: $2\overline{)9.}\quad 4\frac{1}{2}$ There are four 2's in 9, and 1 remainder. The remainder is written over the divisor as above.

5. One half of 9 is —. Nine divided by 2 is —.

6. Find $\frac{1}{2}$ of 7; of 11; of 13; of 5; of 10.

7. Find $\frac{1}{3}$ of 4; of 7; of 10; of 5; of 8.

8. Find $\frac{1}{4}$ of 5; of 6; of 7; of 8; of 9; of 10.

9. Six divided by 2 may be written: $2\overline{)6}$, or $6 \div 2$, or $\frac{6}{2}$.

159. *Read and memorize:*

$$4\overline{)16} \qquad 8\overline{)16} \qquad 7\overline{)14} \qquad 2\overline{)14} \qquad 2\overline{)16}$$

160. Supply quotients in the following:

1. $6 \div 2 = x$.
2. $8 \div 4 = x$.
3. $6 \div 3 = x$.
4. $9 \div 3 = x$.
5. $8 \div 2 = x$.
6. $4 \div 2 = x$.
7. $10 \div 2 = x$.
8. $12 \div 6 = x$.
9. $15 \div 5 = x$.
10. $16 \div 2 = x$.
11. $12 \div 3 = x$.
12. $16 \div 4 = x$.
13. $15 \div 3 = x$.
14. $12 \div 2 = x$.
15. $14 \div 2 = x$.
16. $16 \div 8 = x$.
17. $14 \div 7 = x$.
18. $12 \div 4 = x$.

161. Drill Exercises. Give answers:

	a	*b*	*c*	*d*	*e*	*f*
1.	$\frac{8}{2}$	$\frac{10}{2}$	$\frac{14}{2}$	$\frac{13}{3}$	$\frac{4}{3}$	$\frac{3}{2}$
2.	$\frac{6}{3}$	$\frac{12}{3}$	$\frac{15}{3}$	$\frac{14}{3}$	$\frac{5}{3}$	$\frac{5}{2}$
3.	$\frac{6}{2}$	$\frac{15}{5}$	$\frac{16}{4}$	$\frac{10}{3}$	$\frac{7}{3}$	$\frac{5}{4}$
4.	$\frac{9}{3}$	$\frac{12}{4}$	$\frac{16}{2}$	$\frac{11}{3}$	$\frac{8}{3}$	$\frac{6}{4}$
5.	$\frac{4}{2}$	$\frac{12}{6}$	$\frac{16}{8}$	$\frac{11}{2}$	$\frac{7}{2}$	$\frac{7}{4}$
6.	$\frac{8}{4}$	$\frac{12}{2}$	$\frac{14}{7}$	$\frac{13}{2}$	$\frac{9}{2}$	$\frac{9}{4}$

162. Subtract:

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	8457	9745	9944	4715	6486	9312	7458
	2958	3887	3146	859	2688	6317	2769
2.	9236	5211	8452	8294	9732	8290	7408
	8267	2343	674	2705	5846	1304	980

MULTIPLICATION — LESSON D

163. 1. Add a column of six 3's; of nine 2's.

2. Two 9's are —; nine 2's are —.

3. Find the sum of three 7's; of seven 3's.

4. In 3 weeks there are — days.

164. *Memorize:*

6	9	7	3	2	3
×3	×2	×3	×6	×9	×7
18	18	21	18	18	21

165. Study Exercises.

6	9	7	3	2	3
×3	×2	×3	×6	×9	×7

Study the above exercises until you can give the products without hesitation.

Give the products in the above exercises from right to left.

Give the products from right to left, adding 3, 4, and 5 to each product, thus, adding 3: 21, 24; 18, 21; etc.

Give the products from right to left, adding 6, 7, and 8 to each product, thus, adding 6: 21, 27; 18, 24; etc.

166. Written Exercises.

Multiply:

	a	*b*	*c*	*d*	*e*	*f*
1.	7897	9789	8789	6798	7968	9687
	2	2	2	2	2	2
2.	5467	7654	4567	7456	6745	5764
	3	3	3	3	3	3
3.	4321	1423	3012	2130	2301	3210
	4	4	5	5	6	6
4.	3023	2220	2323	3020	2343	3223
	7	8	7	6	4	5
5.	7605	6750	4032	3120	3213	1203
	20	30	40	60	50	50

DIVISION — LESSON D

167. 1. *Memorize the following:*

6	9	7	3	2	3
$3\overline{)18}$	$2\overline{)18}$	$3\overline{)21}$	$6\overline{)18}$	$9\overline{)18}$	$7\overline{)21}$

2. A boy had 18 marbles and sold $\frac{1}{3}$ of them. How many marbles did he sell? How many marbles did he have left?

3. How many weeks are there in 21 days?

4. A girl had 18 cents. She spent $\frac{1}{2}$ of her money for some paper. What was the cost of the paper? How much money had she left?

5. If 18 apples are divided equally among six boys, what part of the whole number of apples will each boy receive?

6. If 18 pencils are divided into 2 equal groups, how many pencils will there be in each group?

7. What part of 18 inches are 6 inches?

8. What is the ratio of 21 to 7? Of 7 to 21?

9. In finding the number of \$3 there are in \$21, the *unit of measure* is —, and the *quantity measured* is —.

10. What part of 18 feet are 2 feet? Are 9 feet?

11. What is the ratio of 2 feet to 18 feet?

12. Find $\frac{1}{7}$ of \$21. Find $\frac{1}{3}$ of \$18.

13. How many 2-cent stamps can be bought for 18 cents?

168. Study Exercises.

$3\overline{)18}$	$2\overline{)18}$	$3\overline{)21}$	$6\overline{)18}$	$9\overline{)18}$	$7\overline{)21}$
$3\overline{)19}$	$2\overline{)19}$	$3\overline{)22}$	$6\overline{)19}$	$9\overline{)19}$	$7\overline{)22}$
$3\overline{)20}$	$2\overline{)17}$	$3\overline{)23}$	$6\overline{)13}$	$5\overline{)16}$	$7\overline{)23}$
$3\overline{)16}$	$3\overline{)17}$	$8\overline{)17}$	$4\overline{)17}$	$7\overline{)15}$	$7\overline{)16}$

In the study of the above exercises use the following models:

(*a*) In 19 there are six 3's and 1 remainder.

(*b*) One third of 19 is $6\frac{1}{3}$.

Study the above exercises until you can give the quotients without hesitation.

169. Written Exercises.

	a	*b*	*c*	*d*	*e*
1.	$2\overline{)1980}$	$2\overline{)1330}$	$2\overline{)9398}$	$2\overline{)5112}$	$2\overline{)1776}$
2.	$2\overline{)1816}$	$2\overline{)1412}$	$2\overline{)1306}$	$2\overline{)3170}$	$2\overline{)1360}$
3.	$3\overline{)1005}$	$3\overline{)1215}$	$3\overline{)1998}$	$3\overline{)1665}$	$3\overline{)2322}$
4.	$3\overline{)2001}$	$3\overline{)1710}$	$3\overline{)1671}$	$3\overline{)1356}$	$3\overline{)5109}$
5.	$4\overline{)1768}$	$4\overline{)1372}$	$4\overline{)1736}$	$4\overline{)1216}$	$4\overline{)9736}$
6.	$5\overline{)1160}$	$5\overline{)1615}$	$5\overline{)1510}$	$5\overline{)1155}$	$5\overline{)1665}$
7.	$6\overline{)1812}$	$6\overline{)1998}$	$6\overline{)1332}$	$6\overline{)7206}$	$6\overline{)7938}$
8.	$7\overline{)2331}$	$7\overline{)1631}$	$7\overline{)9184}$	$7\overline{)1561}$	$7\overline{)7140}$
9.	$8\overline{)1776}$	$8\overline{)9768}$	$8\overline{)1608}$	$8\overline{)1760}$	$8\overline{)1696}$
10.	$9\overline{)1809}$	$9\overline{)1998}$	$9\overline{)1098}$	$9\overline{)1089}$	$9\overline{)1908}$

170. Oral Problems.*

1. At $2 each, how many chairs can be bought for $8?

MODEL for oral recitation: Since 1 chair costs $2, as many chairs can be bought for $8 as there are $2 in $8, or 4. Four chairs can be bought for $8.

MODEL for written recitation:

4 chairs for $8.

cost of 1 chair, $2)$8

2. If 1 pair of shoes costs $3, how many pairs can be bought for $12?

3. If 1 box of berries costs 5¢, how many boxes can be bought for 20¢?

4. At $3 each, how many hats can be bought for $9?

5. How many yards of ribbon at 4¢ a yard can be bought for 16¢?

6. At 6¢ each, how many tablets can be bought for 18¢?

7. If a boy earns $4 a week, in how many weeks will he earn $20?

8. A farmer sold some sheep for $6 each. He received $18. How many sheep did he sell?

9. If 2 girls sit in each seat, how many seats will 20 girls occupy?

10. A girl earns 8¢ a day. In how many days will she earn 16¢?

* See note, p. 115.

171. Written Problems.

1. A man bought 4 cows. For one he paid $27, for another $32, for another $36, for another $40. How much did he pay for the four cows?

2. At $32 each, what will be the cost of 4 cows?

3. Can you find the cost of the cows in the first problem by multiplication?

4. Can you find the cost of the cows in the second problem by addition?

5. When can you use either addition or multiplication to find the cost of cows?

6. When you can use either addition or multiplication, which is the better to use? Why?

7. A man bought a farm for $3675, and sold it for $5000. Did he gain or lose, and how many dollars?

8. A man bought 6 sheep at $3 each and sold them for $25. Did he gain or lose, and how much?

9. A farmer owned 1860 acres of land. He divided his land into 3 farms, with the same number of acres in each. How many acres were there in each of the farms?

10. At $4 each, how many sheep can be bought for $128?

11. At $5 each, how many barrels of flour can be bought for $65?

12. At 23¢ a yard, what will be the cost of 6 yards of cloth?

172. Oral Problems.

1. How many halves are there in 1 apple? In 1 circle? In 1 dollar? In 1 day?

2. How many halves are there in 2 apples? In $2\frac{1}{2}$ apples? In 3 apples? In $3\frac{1}{2}$ apples? In $4\frac{1}{2}$ days?

3. How many apples must be cut into halves in order to get $\frac{4}{2}$ apples? $\frac{6}{2}$ apples? $\frac{8}{2}$ apples?

4. Tell how many whole apples each of the following is equal to: $\frac{3}{2}$ apples, $\frac{5}{2}$ apples, $\frac{7}{2}$ apples.

5. A man paid 4 boys $\frac{1}{2}$ dollar each for helping him on a Saturday. How many dollars did he pay them all?

6. There were 8 children at a party. A lady gave one half of an orange to each. How many oranges did she give to all?

7. $2\frac{1}{2}$ apples $= \frac{x}{2}$ apples; $\frac{5}{2}$ apples $= -\frac{1}{2}$ apples; $3\frac{1}{2}$ apples $= \frac{x}{2}$ apples.

8. $4\frac{1}{2}$ days $= \frac{x}{2}$ days; $5\frac{1}{2}$ dollars $= \frac{x}{2}$ dollars.

9. $6\frac{1}{2}$ feet $= \frac{x}{2}$ feet; $1\frac{1}{2}$ inches $= \frac{x}{2}$ inches.

10. $\frac{6}{2}$ apples $= -$ apples; $\frac{7}{2}$ oranges $= -\frac{1}{2}$ oranges.

11. Tell how many half apples each of the following is equal to: 2 apples, $2\frac{1}{2}$ apples, 4 apples, $4\frac{1}{2}$ apples, $5\frac{1}{2}$ apples, $3\frac{1}{2}$ apples, 6 apples.

12. Seven half dollars are equal to how many dollars?

13. A girl spent 5 half days in the city. How much more than 2 days did she spend there?

173. Drill Exercises.

6×2 is read, 6 multiplied by 2. It is the same as $\begin{array}{r} 6. \\ \times\ 2 \\ \hline \end{array}$

Supply products for x, and add to each product the number above the column as in a: 12, 14; 16, 18.

Give answers only:

	(2) *a*	(3) *b*	(5) *c*	(7) *d*
1.	$6 \times 2 = 12, 14$	$8 \times 2 = 16, 19$	$7 \times 3 = x$	$3 \times 2 = x$
2.	$4 \times 4 = 16, 18$	$4 \times 3 = x$	$2 \times 5 = x$	$5 \times 3 = x$
3.	$5 \times 2 = x$	$6 \times 3 = x$	$4 \times 2 = x$	$3 \times 4 = x$
4.	$3 \times 3 = x$	$7 \times 2 = x$	$3 \times 5 = x$	$2 \times 6 = x$
5.	$2 \times 3 = x$	$3 \times 6 = x$	$9 \times 2 = x$	$2 \times 8 = x$

174. Drill Exercises.

Supply quotients in place of x.

	a	*b*	*c*	*d*
1.	$18 \div 3 = x$	$12 \div 4 = x$	$16 \div 2 = x$	$19 \div 3 = x$
2.	$14 \div 7 = x$	$18 \div 6 = x$	$18 \div 9 = x$	$11 \div 2 = x$
3.	$21 \div 3 = x$	$16 \div 8 = x$	$15 \div 3 = x$	$13 \div 6 = x$

175. Written Exercises.

	a	*b*	*c*	*d*	*e*
1.	978,978	897,897	679,769	587,857	459,596
	$\times 2$	$\times 2$	$\times 2$	$\times 2$	$\times 2$
2.	765,765	657,657	547,574	637,673	564,767
	$\times 3$	$\times 3$	$\times 3$	$\times 3$	$\times 3$
3.	324,243	432,432	304,203	321,321	123,123
	$\times 4$	$\times 4$	$\times 4$	$\times 5$	$\times 6$

176. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*
3	9	8	7	6	6	1	7	6	9	9	5	7
5	3	2	4	1	3	9	3	4	1	3	5	6
5	7	8	6	9	7	8	7	1	4	6	7	9
7	5	9	3	8	4	2	3	9	6	4	4	3
5	3	2	4	1	5	8	6	8	7	8	6	7
5	7	8	6	9	5	4	4	2	3	2	8	3
4	8	9	7	8	9	9	8	2	2	7	9	7
8	6	7	8	9	6	5	8	9	8	6	9	8

Name five combinations whose sums are ten.

When these combinations occur in a column, they may be taken together. Exercise *a* above may be added: 12, 22, 29, 39, 42. Add the above exercises in a similar manner.

177. Written Exercises.

Subtract:

a	*b*	*c*	*d*	*e*
16,043	72,345	90,234	45,803	84,087
9,876	34,567	27,840	14,769	28,309

178. Oral Exercises.

Add a column of ten 3's; of five 4's; of five 5's.

Memorize:

8	9	5	3	3	4	5
× 3	× 3	× 4	× 8	× 9	× 5	× 5
24	27	20	24	27	20	25

MULTIPLICATION — LESSON E

179. Study Exercises.

8	9	5	3	3	4	5
×3	×3	×4	×8	×9	×5	×5

Study the above exercises until you can give the products without hesitation.

Give the products, from right to left; adding 4 to each product; adding 6 to each product.

180. Multiply 3457 by 23.

MODEL:

3457
23
10371
6914
79511

Multiply 3457 first by 3, and write the product. Next, multiply by 2. Two 7's are 14. Write the 4 under the 2. After completing the multiplication by 2, draw a line and add the products.

181. Written Exercises.

Multiply:

1.	3457×23	10.	3243×45	19.	3223×89
2.	6789×23	11.	4545×54	20.	2130×98
3.	9876×32	12.	3454×45	21.	3231×89
4.	5647×32	13.	2050×54	22.	3020×98
5.	8975×23	14.	3524×54	23.	3123×84
6.	3240×35	15.	2320×67	24.	2323×29
7.	6978×32	16.	3023×67	25.	4534×15
8.	4036×23	17.	1323×67	26.	3750×13
9.	9380×32	18.	2032×67	27.	4567×20

182. Oral Problems.

1. At \$3 each, how many chairs can be bought for \$18?

2. How much will 4 tables cost at \$5 each?

3. If 8 hats cost \$16, how much will 1 hat cost?

4. At \$4 each, how many desks can be bought for \$12?

5. How much will 6 tablets cost at 3¢ each?

6. How many pencils at 2¢ each can be bought for 8¢?

7. At the rate of 4 for 12¢, what is the cost of 1 pencil?

8. If 3 packages of popcorn cost 15¢, what is the cost of 1 package?

9. How much will 3 boxes of berries cost at 6¢ per box?

10. Four boys rode on a street car. They paid 5¢ each. How much did it cost the four boys?

11. Mary spent 3 weeks with her aunt. How many days did she spend with her?

12. George paid 21¢ for 3 tablets. How much was this for each tablet?

13. Ethel walks 2 miles to school. How far does she walk in going and coming each day? How far does she walk in 1 week?

14. Frank is 7 years old. His brother is 21 years old. His brother is how many times as old as Frank?

183. Written Problems.

1. A boy rode 15 miles in 3 hours. What was the average rate per hour?

2. A train runs 96 miles in 4 hours. What is the average rate per hour?

3. A grocer sold $1380 worth of goods in 6 days. Find the average daily sales for the week.

4. George weighs 84 lb.; Walter weighs 76 lb. How much will the two boys together weigh? What is the average weight of the two boys? Which of the boys weighs more than the average weight?

5. There are 50 pupils in Room A; 43 pupils in Room B; 40 pupils in Room C; and 39 pupils in Room D. How many pupils are there in the four rooms? Find the average number of pupils in a room. Which of the rooms have more than the average number of pupils? Which have less than the average number? Has any room the average number of pupils?

6. A farmer sold a grocer 7 lb. of butter at 23¢ a pound. What was the value of the butter? The farmer bought of the grocer 2 lb. of coffee at 25¢ a pound, and 3 lb. of tea at 35¢ a pound. What was the value of the coffee and tea? Did the farmer owe the grocer or the grocer owe the farmer, and how much?

7. Find $\frac{1}{8}$ of $1760. Find $\frac{1}{5}$ of $1600.

8. Which is the more, $\frac{1}{3}$ of $120 or $\frac{1}{4}$ of $176?

DIVISION — LESSON E

184. 1. *Memorize the following:*

$$\begin{array}{ccccccc} 8 & 9 & 5 & 3 & 3 & 4 & 5 \\ 3\overline{)24} & 3\overline{)27} & 4\overline{)20} & 8\overline{)24} & 9\overline{)27} & 5\overline{)20} & 5\overline{)25} \end{array}$$

2. Eight is $\frac{1}{3}$ of —. 5 is $\frac{1}{4}$ of —. 3 is $\frac{1}{8}$ of —.

3. Three is $\frac{1}{9}$ of —. 4 is $\frac{1}{5}$ of —. 5 is $\frac{1}{5}$ of —.

4. What is $\frac{1}{8}$ of \$24? What is $\frac{1}{5}$ of \$25?

5. What is $\frac{1}{4}$ of 20? What is $\frac{1}{3}$ of 27?

6. In 27 there are — 3's. In 28 there are — 3's, and — remainder.

7. In 24 there are — 3's. In 25 there are — 3's, and — remainder.

8. What is $\frac{1}{4}$ of 20? What is $\frac{1}{4}$ of 21?

9. What is the ratio of 5 to 20? Of 20 to 5?

10. How many \$5 units are there in \$25?

11. How many \$1 units are there in \$25?

12. How many units of 3 feet are there in 24 feet?

13. How many times must the yardstick be applied in measuring 24 feet?

14. Nine feet are $\frac{1}{3}$ of —. \$4 are $\frac{1}{5}$ of \$—.

15. There are 24 hours in one day. How many hours are there in $\frac{1}{3}$ of a day?

16. A boy had 20¢. He bought a tablet that cost $\frac{1}{4}$ of his money. What was the cost of the tablet? The boy had —¢ left.

17. What is $\frac{1}{4}$ of 20¢? What is $\frac{1}{5}$ of 20¢?

185. Study Exercises.

$3\overline{)24}$	$3\overline{)27}$	$4\overline{)20}$	$8\overline{)24}$	$9\overline{)27}$	$5\overline{)20}$	$5\overline{)25}$
$3\overline{)25}$	$3\overline{)28}$	$4\overline{)21}$	$8\overline{)25}$	$9\overline{)28}$	$5\overline{)21}$	$5\overline{)26}$
$3\overline{)26}$	$3\overline{)29}$	$4\overline{)22}$	$8\overline{)26}$	$9\overline{)29}$	$5\overline{)22}$	$5\overline{)27}$

Study the above exercises until you can give the quotients without hesitation.

Give the quotients and the remainders, if any.

Give the quotients with the remainders expressed as fractions. Review Exercise 168, p. 124.

186. Written Exercises.

Use the numbers above the columns as divisors:

	3, 2		4, 3		5		6
1.	242,724	7.	201,620	13.	202,520	19.	181,213
2.	272,427	8.	177,808	14.	252,025	20.	139,392
3.	251,515	9.	217,371	15.	152,520	21.	738,798
4.	266,664	10.	222,200	16.	101,520	22.	193,278
5.	267,267	11.	982,208	17.	252,015	23.	792,192
6.	287,878	12.	140,142	18.	267,676	24.	180,192

187. Write in a column and add:

1. \$1045, \$72.05, \$108.75, \$ 9.18, \$.75, \$704.
2. \$304.50, \$40.20, \$1000, \$.85, \$19.90, \$1.25.
3. \$6.40, \$200.45, \$3.05, \$89.26, \$6, \$600, \$8.30.
4. \$300, \$8, \$4000, \$.12, \$20, \$10.50, \$.64.

188. Drill Exercises.

Give quotients and express the remainders as fractions:

1. $\frac{20}{4}, \frac{21}{4}, \frac{22}{4}$.
2. $\frac{15}{3}, \frac{16}{3}, \frac{17}{3}$.
3. $\frac{25}{5}, \frac{26}{5}, \frac{27}{5}$.
4. $\frac{18}{9}, \frac{19}{9}, \frac{20}{9}$.
5. $\frac{24}{8}, \frac{25}{8}, \frac{26}{8}$.
6. $\frac{20}{5}, \frac{21}{5}, \frac{22}{5}$.
7. $\frac{16}{4}, \frac{17}{4}, \frac{18}{4}$.
8. $\frac{18}{3}, \frac{19}{3}, \frac{20}{3}$.
9. $\frac{12}{6}, \frac{13}{6}, \frac{14}{6}$.
10. $\frac{14}{7}, \frac{15}{7}, \frac{16}{7}$.
11. $\frac{27}{9}, \frac{28}{9}, \frac{29}{9}$.
12. $\frac{16}{8}, \frac{17}{8}, \frac{18}{8}$.
13. $\frac{21}{7}, \frac{22}{7}, \frac{23}{7}$.
14. $\frac{18}{6}, \frac{19}{6}, \frac{20}{6}$.
15. $\frac{15}{5}, \frac{16}{5}, \frac{17}{5}$.

189. Written Exercises.

1. Multiply \$6.50 by 3.

MODEL:
$$\begin{array}{r} \$6.50 \\ 3 \\ \hline \$19.50 \end{array}$$

Multiply as in previous exercises, and point off two places for cents.

2. \$656.50 × 2
3. \$329.40 × 3
4. \$345.54 × 4
5. \$453.45 × 5
6. \$323.10 × 6
7. \$897.68 × 2
8. \$950.75 × 3
9. \$432.50 × 4
10. \$345.24 × 5
11. \$230.20 × 6
12. \$302.23 × 7
13. \$310.32 × 8
14. \$231.12 × 9
15. \$330.30 × 9
16. \$103.23 × 8

190. Written Problems.

Give the analysis for each:

1. At \$4.75 each, what will be the cost of 3 sheep?
2. What will be the cost of 4 chairs at \$3.25 each?
3. At \$42.50 each, what will be the cost of 4 cows?
4. A boy earns \$15.75 a month. How much will he earn in 3 months?

5. How much will 3 railroad tickets from Chicago to San Francisco cost at $62.50 each?

6. A man pays $13.50 a month rent for a house. How much will this amount to in 4 months?

7. Find the cost of 3 tons of coal at $6.75 a ton.

8. A man bought sheep at $4 each. He paid $176 for the sheep. How many sheep did he buy?

9. What is the unit of measure in Problem 8?

10. A man owned 360 acres of land. He sold $\frac{1}{3}$ of it. How many acres did he sell? How many acres did he have left?

191. Oral Exercises.

Add as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*
2	4	2	3	3	3	3	2	2	4	2	9	1	5
3	5	2	4	3	5	6	5	4	4	7	1	3	4
5	8	7	5	4	2	1	3	4	2	1	4	6	8
2	3	9	8	3	3	3	2	2	4	2	5	1	3
3	4	2	3	3	5	6	5	4	4	7	1	3	5
8	5	2	4	5	8	4	3	7	2	6	4	8	4
3	3	4	8	9	4	8	8	6	9	8	9	6	7
9	7	6	2	6	8	8	9	7	9	6	1	6	3

Whenever two numbers whose sum is not more than 9 are to be added to 10, 20, 30, etc., take both numbers together.

Exercise *a* above may be added: 12, 20, 25, 30, 35. Add the above exercises in a similar manner.

MULTIPLICATION — LESSON F

192. 1. *Memorize the following:*

6	7	6	4	4	5	6
×4	×4	×5	×7	×6	×6	×6
24	28	30	28	24	30	36

2. Count by 5's to 30; by 6's to 36.

3. Count by 4's to 28; by 7's to 28.

4. There are 7 days in one week. How many days are there in 4 weeks?

5. There are 4 quarts in one gallon. How many quarts are there in six gallons?

6. What is the product of 4 and 7? Of 4 and 6?

7. Alice bought 6 pencils at 4¢ each. She handed the clerk a 25-cent piece. How much change should she receive?

8. A boy sold 6 papers at 5¢ each. How much money did he receive for all?

9. At $4 each, what will be the cost of 7 chairs?

10. What will be the cost of 6 tablets at 6¢ each?

11. At the rate of 5 marbles for a cent, how many marbles can be bought for 6¢?

12. A girl bought 4 yd. of ribbon at 6¢ a yard. She gave the clerk 25 cents. How much change should she receive?

13. How many cents are 6 nickels? How many dollars are six 5-dollar gold pieces?

193. Study Exercises.

6	7	6	4	4	5	6
×4	×4	×5	×7	×6	×6	×6

Study the above exercises until you can give the products without hesitation.

Give the products from right to left, adding the following numbers to each product: 3, 4, 7, 8.

194. Multiply:

1. 677,676 × 34	11. 654,564 × 56	21. 321,213 × 78
2. 765,756 × 24	12. 365,456 × 56	22. 203,320 × 68
3. 456,746 × 14	13. 246,365 × 65	23. 332,223 × 58
4. 375,647 × 34	14. 654,321 × 56	24. 123,123 × 48
5. 263,746 × 24	15. 506,430 × 46	25. 301,203 × 38
6. 565,656 × 54	16. 434,343 × 67	26. 332,233 × 89
7. 456,546 × 45	17. 342,434 × 57	27. 312,013 × 79
8. 346,543 × 54	18. 234,342 × 47	28. 120,320 × 69
9. 425,636 × 35	19. 324,130 × 37	29. 231,032 × 59
10. 654,321 × 45	20. 123,432 × 27	30. 123,320 × 49

195. Solve:

$913.78	$935.36	$8312.75	$835.00
−$535.79	−$145.68	−$2353.76	−$135.25

What is the answer in division called?

DIVISION — LESSON F

196. 1. *Memorize the following:*

6	7	6	4	4	5	6
4)24	4)28	5)30	7)28	6)24	6)30	6)36

2. How many weeks are there in 28 days?

3. How many gallons are there in 24 quarts?

4. How many nickels are there in 30 cents?

5. What is $\frac{1}{4}$ of \$24? What is $\frac{1}{6}$ of \$36?

6. \$6 is $\frac{1}{5}$ of \$—. \$7 is $\frac{1}{4}$ of \$—.

7. At 5¢ each, how many oranges can be bought for 30¢?

8. At \$4 each, how many chairs can be bought for \$28?

9. A girl had 30 cents. She spent $\frac{1}{5}$ of her money for a tablet. What was the cost of the tablet?

10. How many pounds of sugar at 6¢ a pound will cost 24¢?

11. What is the unit of measure in Problem 8?

12. There are 36 pupils in a schoolroom. There are 6 pupils seated in each row. How many rows of seats are there in the room?

13. If each stove costs \$7, how many stoves can be bought for \$28?

14. If a boy earns \$6 each month, how long will it take him to earn \$24?

15. What is the ratio of 6 to 24? Of 24 to 6?

197. Study Exercises.

$4\overline{)24}$	$4\overline{)28}$	$5\overline{)30}$	$7\overline{)28}$	$6\overline{)24}$	$6\overline{)30}$	$6\overline{)36}$
$4\overline{)25}$	$4\overline{)29}$	$5\overline{)31}$	$7\overline{)29}$	$6\overline{)25}$	$6\overline{)31}$	$6\overline{)37}$
$4\overline{)26}$	$4\overline{)30}$	$5\overline{)32}$	$7\overline{)30}$	$6\overline{)26}$	$6\overline{)32}$	$6\overline{)38}$
$4\overline{)27}$	$4\overline{)31}$	$5\overline{)33}$	$7\overline{)31}$	$7\overline{)27}$	$6\overline{)33}$	$6\overline{)39}$

Study the above exercises until you can give the quotients without hesitation.

Give the quotients and the remainders, if any.

Give the quotients with the remainders expressed as fractions.

198. Written Exercises.

Divide the numbers in each column by the numbers above the columns.

4, 3	5, 2	6, 3	7, 2
1. 242,824	11. 303,305	21. 243,024	31. 212,821
2. 268,264	12. 252,030	22. 254,544	32. 296,968
3. 264,268	13. 318,180	23. 266,736	33. 233,814
4. 306,704	14. 323,230	24. 393,936	34. 226,257
5. 307,048	15. 272,780	25. 272,780	35. 309,401
6. 257,770	16. 267,605	26. 267,606	36. 156,268
7. 226,570	17. 813,215	27. 813,215	37. 870,401
8. 270,264	18. 627,110	28. 627,120	38. 994,714
9. 936,536	19. 758,230	29. 758,130	39. 169,547
10. 623,012	20. 126,315	30. 126,315	40. 714,931

199. Drill Exercises.

Give quotients with the remainders expressed as fractions:

1. $\frac{30}{6}, \frac{18}{3}, \frac{24}{8}$.
2. $\frac{14}{2}, \frac{27}{9}, \frac{16}{8}$.
3. $\frac{15}{5}, \frac{24}{4}, \frac{28}{7}$.
4. $\frac{30}{5}, \frac{24}{3}, \frac{16}{4}$.
5. $\frac{12}{2}, \frac{24}{6}, \frac{18}{9}$.
6. $\frac{24}{3}, \frac{21}{7}, \frac{15}{3}$.
7. $\frac{18}{5}, \frac{14}{3}, \frac{21}{4}$.
8. $\frac{32}{6}, \frac{26}{5}, \frac{17}{8}$.
9. $\frac{20}{9}, \frac{15}{4}, \frac{13}{5}$.
10. $\frac{24}{7}, \frac{10}{4}, \frac{17}{5}$.
11. $\frac{15}{6}, \frac{27}{8}, \frac{28}{9}$.
12. $\frac{13}{2}, \frac{17}{3}, \frac{20}{6}$.
13. $\frac{11}{4}, \frac{18}{6}, \frac{33}{5}$.
14. $\frac{23}{5}, \frac{17}{3}, \frac{19}{6}$.
15. $\frac{23}{3}, \frac{30}{7}, \frac{18}{4}$.
16. $\frac{12}{9}, \frac{19}{3}, \frac{26}{3}$.
17. $\frac{14}{6}, \frac{17}{7}, \frac{18}{8}$.
18. $\frac{23}{7}, \frac{11}{3}, \frac{10}{8}$.

200. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*
3	5	2	6	6	8	6	6	6	9	6	9	5
8	7	9	7	6	8	6	7	9	7	5	8	7
9	8	9	7	8	4	8	7	5	4	9	3	8
3	5	2	6	6	8	6	6	6	9	5	9	5
8	7	9	7	6	8	6	7	9	7	6	8	8
9	8	9	7	8	7	8	5	5	3	8	5	7
4	7	2	1	5	9	3	3	7	8	6	8	6
6	3	8	9	5	4	9	2	8	9	6	7	4

Whenever any two numbers are to be added to 10, 20, 30, etc., take both numbers together.

Exercise *a* above may be added: 10, 27, 30, 47, 50.

Exercise *b* above may be added: 10, 25, 30, 45, 50.

Add the above exercises in a similar manner.

Add the above exercises from the top down.

201. Oral Exercises.

Review Exercises 90 and 130.

1. If a pie is cut into thirds, it is cut into — equal pieces.

2. A woman gave each boy $\frac{1}{3}$ of a pie. She gave the boys 2 pies. How many boys were there?

3. A woman gave each of 9 boys $\frac{1}{3}$ of a pie. She gave the boys — pies.

4. A woman gave each boy $\frac{1}{3}$ of a pie. It took $3\frac{1}{3}$ pies. There were — boys.

5. A woman divided two pies equally among 6 boys. What part of a pie did each boy receive?

6. In one pie there are — thirds of a pie.

7. In 2 apples there are — thirds of an apple.

8. $2\frac{1}{3}$ apples $= \frac{?}{3}$ apples. $3\frac{1}{3}$ feet $= \frac{?}{3}$ feet.

9. $\frac{12}{3}$ inches $=$ — inches. $\frac{13}{3}$ inches $=$ — $\frac{1}{3}$ inches.

10. $\frac{15}{3}$ pies $=$ — pies. $\frac{14}{3}$ apples $=$ — $\frac{1}{3}$ apples.

11. $4\frac{1}{3}$ yards $= \frac{?}{3}$ yards. $\frac{5}{2}$ days $=$ — $\frac{1}{2}$ days.

12. $\frac{9}{3}$ apples $=$ — apples. $\frac{10}{3}$ pies $=$ — $\frac{1}{3}$ pies.

13. $5\frac{1}{2}$ apples and $2\frac{1}{2}$ apples are — apples.

14. $3\frac{1}{3}$ yards and $2\frac{1}{3}$ yards are — yards.

15. $2\frac{1}{3}$ pies and $1\frac{2}{3}$ pies are — pies.

16. $5\frac{1}{3}$ feet and $2\frac{2}{3}$ feet are — feet.

MULTIPLICATION — LESSON G

202. 1. *Memorize the following:*

8	9	7	4	4	5
×4	×4	×5	×8	×9	×7
32	36	35	32	36	35

2. How many days are there in 5 weeks?

3. Nine gallons are how many quarts?

4. At 8¢ a yard, what will be the cost of 4 yards of ribbon?

5. There are 8 quarts in one peck. How many quarts are there in 4 pecks?

6. Seven nickels are how many cents?

7. How much will 7 bars of soap cost at 5¢ each?

8. At $9 a ton, how much will 4 tons of coal cost?

9. How much will 4 boxes of berries cost at 8¢ a box?

10. Count by 4's to 36; by 5's to 35; by 8's to 32.

11. At the rate of 9 miles an hour, how far will a boat sail in 4 hours?

12. If there are 5 rows of seats in a schoolroom, and 7 seats in each row, how many seats are there in the room?

13. A boy delivers 5 quarts of milk each day. How many quarts will he deliver in one week?

203. Study Exercises.

8	9	7	4	4	5
4	4	5	8	9	7

Study the above until you can give the products without hesitation.

Give the products from right to left, adding the following to each product: 6, 4, 7, 9.

204. Written Exercises.

1. $898{,}989 \times 34$
2. $989{,}898 \times 34$
3. $696{,}896 \times 34$
4. $789{,}987 \times 34$
5. $579{,}869 \times 34$
6. $456{,}789 \times 34$
7. $234{,}324 \times 89$
8. $324{,}432 \times 89$
9. $432{,}342 \times 89$
10. $123{,}432 \times 89$
11. $343{,}210 \times 89$
12. $543{,}345 \times 67$
13. $543{,}235 \times 75$
14. $676{,}767 \times 45$
15. $456{,}657 \times 45$
16. $765{,}432 \times 45$
17. $123{,}567 \times 25$
18. $345{,}765 \times 25$

205. Oral Exercises.

Supply the number in place of x.

1. $6 \times 6 = 9 \times x$
2. $6 \times 4 = 8 \times x$
3. $6 \times 5 = 5 \times x$
4. $8 \times 2 = 4 \times x$
5. $2 \times 9 = 6 \times x$
6. $3 \times 5 = 5 \times x$
7. $2 \times 6 = 4 \times x$
8. $3 \times 6 = 9 \times x$
9. $4 \times 9 = 6 \times x$
10. $5 \times 4 = 2 \times x$
11. $8 \times 3 = 4 \times x$
12. $5 \times 6 = 6 \times x$
13. $4 \times 4 = 2 \times x$
14. $4 \times 6 = 8 \times x$
15. $6 \times 5 = 3 \times x$
16. $6 \times 3 = 2 \times x$

DIVISION — LESSON G

206. 1. *Memorize the following:*

8	9	7	4	4	5
4)32	4)36	5)35	8)32	9)36	7)35

2. At 5¢ each, how many oranges can be bought for 35¢?

3. What part of $ 36 is $ 9? What is the ratio of $ 9 to $ 36?

4. If 9 chairs cost $ 36, what will be the cost of 1 chair?

5. If a horse is fed 9 quarts of oats a day, how many days will 36 quarts last?

6. What is the unit of measure in Problem 5?

7. There are 8 pints in 1 gallon. How many gallons are there in 32 pints?

8. If a horse travels 36 miles in 9 hours, what is the average rate per hour?

9. If 7 boys together have 35 marbles, what is the average number for each boy?

10. Thirty-six boxes of berries were picked from a garden in 4 days. What was the average number of boxes for each day?

11. The number of boxes of berries picked from a garden averages 4 each day. How many boxes will be picked in 8 days?

12. If a boy rides his wheel at an average rate of 5 miles an hour, how far will he ride in 9 hours?

207. Study Exercises.

$4\overline{)32}$	$4\overline{)36}$	$5\overline{)35}$	$8\overline{)32}$	$9\overline{)36}$	$7\overline{)35}$
$4\overline{)33}$	$4\overline{)37}$	$5\overline{)36}$	$8\overline{)33}$	$9\overline{)37}$	$7\overline{)36}$
$4\overline{)34}$	$4\overline{)38}$	$5\overline{)37}$	$8\overline{)34}$	$9\overline{)38}$	$7\overline{)37}$
$4\overline{)35}$	$4\overline{)39}$	$5\overline{)38}$	$8\overline{)35}$	$9\overline{)39}$	$7\overline{)38}$

Give the quotients and the remainders, if any.

Give the quotients with the remainders expressed as fractions.

With 4 as a divisor, what is the largest remainder possible? Why?

What is the largest remainder possible with 3 as a divisor?

If the quotient is $3\frac{1}{4}$, can you tell what the divisor was?

208. Written Exercises.

Divide the numbers in each column by the numbers above the column.

4, 3, 2	5, 2, 3	7, 4, 3	8, 4, 2
1. 323,632	6. 388,385	11. 352,821	16. 322,416
2. 356,356	7. 378,270	12. 387,471	17. 339,536
3. 339,392	8. 232,375	13. 248,780	18. 275,464
4. 343,436	9. 183,180	14. 283,115	19. 984,804
5. 387,872	10. 867,325	15. 239,708	20. 115,304

209. Oral Exercises.

1. How can you find $\frac{1}{2}$ of a number? $\frac{1}{3}$ of a number?

2. What is $\frac{1}{2}$ of 4? Of 6? Of 8? Of 12? Of 7? Of 5? Of 9? Of 19? Of 24?

3. What is $\frac{1}{3}$ of 6? Of 12? Of 7? Of 8? Of 10? Of 11? Of 13? Of 14? Of 9?

4. When you know what $\frac{1}{2}$ of a number is, how can you find what the number is?

5. When you know what $\frac{1}{3}$ of a number is, how can you find what that number is?

6. When you know what $\frac{1}{3}$ of a number is, how can you find $\frac{2}{3}$ of the number?

7. Find $\frac{1}{3}$ of 12. Find $\frac{2}{3}$ of 12. Find $\frac{2}{3}$ of 9.

8. If $\frac{1}{2}$ of a number is 3, what is the number?

9. If $\frac{1}{3}$ of a number is 5, what is the number?

10. If $\frac{1}{3}$ of a number is 4, what is the number?

11. If $\frac{2}{3}$ of a number is 4, what is $\frac{1}{3}$ of the number?

12. If $\frac{2}{3}$ of a number is 4, what is the number?

13. If $\frac{2}{3}$ of a number is 6, what is the number?

14. If $\frac{2}{3}$ of a number is 2, what is $\frac{1}{3}$ of the number?

15. What is $\frac{2}{3}$ of 6? Of 9? Of 12? Of 3?

16. What is $\frac{1}{3}$ of 1? Of 2? Of 3? Of 4? Of 5?

17. If $\frac{1}{3}$ of the number of marbles a boy has is 6, what are $\frac{2}{3}$ of the number of marbles?

18. If $\frac{2}{3}$ of the number of books a girl has are 6, what is $\frac{1}{3}$ of the number of books she has? How many books has she?

210. Oral Problems.*

1. What are $\frac{2}{3}$ of \$15?

MODEL for oral recitation: Since $\frac{1}{3}$ of \$15 is \$5, $\frac{2}{3}$ of \$15 are 2 times \$5, or \$10.

MODEL for written recitation:

\$5 is $\frac{1}{3}$ of \$15.
$3\overline{)\$15}$

\$5 is $\frac{1}{3}$ of \$15.
$\times 2$
\$10 are $\frac{2}{3}$ of \$15.

2. What are $\frac{2}{3}$ of \$18? Of \$24? Of 15 days?

3. What are $\frac{2}{3}$ of 21 days? Of 12¢? Of 15 ft.?

4. What are $\frac{3}{4}$ of \$16? Of 12 days? Of \$24?

5. What are $\frac{3}{5}$ of \$15? Of \$20? Of 25¢?

6. At 18¢ a yard, how much will $\frac{2}{3}$ of a yard of cloth cost?

7. There are 12 months in 1 year. How many months are there in $\frac{3}{4}$ of a year?

8. How many inches are there in $\frac{2}{3}$ of a foot?

9. How many pints are there in $\frac{3}{4}$ of a gallon?

10. A boy had 16 marbles. He sold $\frac{3}{4}$ of them. How many marbles did he sell?

11. A girl bought $\frac{3}{4}$ of a yard of ribbon at 20¢ a yard. How much did the ribbon cost her?

12. A boy had 12 miles to travel. He rode $\frac{3}{4}$ of the distance and walked the remainder. How far did he ride? How far did he walk?

* See note, p. 115.

211. Written Problems.

1. Find the cost of 19 cows at $34 each.

2. At $7 a ton, how many tons of coal can be bought for $224?

3. Find the number of square rods in a field 43 rods long and 29 rods wide.

4. If a train travels at an average rate of 45 mi. an hour, how far will it travel in one day?

5. A boat traveled 3150 miles in one week. What was the average distance traveled each day?

6. A farmer raised 32 bu. of oats to the acre. How many bushels did he raise from 28 acres?

7. A boy picked 78 boxes of apples in 6 days. What was the average number of boxes picked each day?

8. There are 60 seconds in one minute and 60 minutes in one hour. How many seconds are there in one hour?

9. How many minutes are there in one day?

10. How many weeks are there in 364 days?

11. A man sold hay at $8 a ton. He received $96 for it. How many tons did he sell?

12. How much is hay worth a ton when $72 is paid for 6 tons?

13. How many days are there in 14 weeks?

14. Find the value of 4 carloads of coal, each containing 16 tons, at $6 a ton.

212. Oral Problems.*

1. If \$15 is $\frac{3}{4}$ of the cost of a stove, what is the cost of the stove?

MODEL for oral recitation: If \$15 is $\frac{3}{4}$ of the cost of the stove, $\frac{1}{4}$ of the cost of the stove is $\frac{1}{3}$ of \$15, or \$5. If \$5 is $\frac{1}{4}$ of the cost of the stove, the cost of the stove is 4 times \$5, or \$20.

MODEL for written recitation:

\$5 is $\frac{1}{4}$ of the cost.
3)\$15 is $\frac{3}{4}$ of the cost.

\$5 is $\frac{1}{4}$ of the cost.
× 4
\$20 is $\frac{4}{4}$ of the cost.

2. If \$12 is $\frac{3}{4}$ of the cost of a suit of clothes, what is the cost of the suit?

3. If \$20 is $\frac{4}{5}$ of the cost of a cow, what is the cost of the cow?

4. If $\frac{2}{3}$ of the cost of a book is 18¢, what is the cost of the book?

5. If $\frac{3}{5}$ of the cost of a cap is 24¢, what is the cost of the cap?

6. A boy sold $\frac{2}{3}$ of his marbles for 14¢. At the same rate, how much were all of his marbles worth?

7. If $\frac{3}{4}$ yd. of cloth is worth 21¢, how much is 1 yd. worth?

8. A girl spent 9 weeks visiting her aunt. This was $\frac{3}{4}$ of her vacation. How long was her vacation?

9. Fred's age is 12 years. He is $\frac{4}{5}$ as old as Harry. How old is Harry?

* See note, p. 115.

MULTIPLICATION — LESSON H

213. 1. *Memorize the following:*

8	9	7	7	5	5	6
5	5	6	7	8	9	7
40	45	42	49	40	45	42

2. Count by 5's to 45; by 9's to 45.

3. Count by 6's to 42; by 7's to 49.

4. How many days are there in 6 weeks? In 7 weeks?

5. Eight nickels are how many cents?

6. Nine nickels are how many cents?

7. Count by 8's to 40; by 4's to 40.

8. What will be the cost of 6 clocks at $7 each?

9. If oranges are worth 5¢ each, what will be the cost of 9 oranges?

10. What will be the cost of 8 loaves of bread at 5¢ a loaf?

11. In preparing for a party, some girls bought 7 boxes of berries at 6¢ each. They handed the dealer a half-dollar. How much change should they receive?

12. In planting his orchard, a farmer set out 7 rows of trees with 7 trees in each row. Make a drawing to show the trees. How many trees did he set out?

13. How many square inches are there in an oblong 7 in. long and 6 in. wide? Make a drawing to show this.

214. Study Exercises.

8	9	7	7	5	5	6
×5	×5	×6	×7	×8	×9	×7

Study the above exercises until you can give the products without hesitation.

Give the products from right to left, adding the following to each product: 6, 7, 8, 9.

215. Written Exercises.

1. 897,879 × 45
2. 789,789 × 45
3. 687,969 × 45
4. 987,654 × 45
5. 456,789 × 45
6. 978,645 × 35
7. 697,548 × 35
8. 569,784 × 35
9. 678,945 × 25
10. 987,456 × 25
11. 765,675 × 67
12. 567,576 × 67
13. 657,756 × 67
14. 456,767 × 67
15. 765,432 × 67
16. 543,435 × 89
17. 435,534 × 89
18. 234,530 × 89
19. 524,321 × 89
20. 454,302 × 89

216. Write in a column and add:

1. $375.40, $1087.09, $9.75, $84.75, $450, $90.
2. $90, $100.25, $.90, $1.75, $3750, $80.80, $90.
3. $3.75, $9375, $.97, $105, $7.25, $725, $8.06.
4. $.95, $95, $9.50, $950, $9500, $90.50, $5.95.
5. $1.75, $175, $17.50, $1750, $175.50, $17.05.

DIVISION — LESSON H

217. 1. *Memorize the following:*

8	9	7	7	5	5	6
$5\overline{)40}$	$5\overline{)45}$	$6\overline{)42}$	$7\overline{)49}$	$8\overline{)40}$	$9\overline{)45}$	$7\overline{)42}$

2. What part of 40 is 5? What part of 40 is 8?

3. What part of \$45 is \$9? What part of \$45 is \$5?

4. What is the ratio of \$5 to \$40? Of \$40 to \$5?

5. A girl spent 6 weeks in the country. How many days did she spend in the country?

6. A boy spent 49 days in the city. How many weeks did he spend in the city?

7. A boy sold papers at 5¢ each. He received 45¢. How many papers did he sell?

8. A girl receives 5¢ a day for helping her aunt. In how many days will she earn 40¢?

9. A girl picked 6 boxes of berries and sold them for 7¢ a box. How much did she receive for them?

10. A farmer set out 45 apple trees in 5 rows. How many trees did he set out in each row?

11. There are 42 square inches in an oblong. The oblong is 7 inches long. How wide is it?

12. There are 40 square inches in an oblong. The oblong is 5 inches wide. How long is it?

13. A man spent 45¢ for car fares. He paid 5¢ for each ride. How many times did he ride?

218. Study Exercises.

5)40	5)45	6)42	7)49	8)40	9)45	7)42
5)41	5)46	6)43	7)50	8)41	9)46	7)43
5)42	5)47	6)44	7)51	8)42	9)47	7)44
5)43	5)48	6)45	7)52	8)43	9)48	7)45
5)44	5)49	6)46	7)53	8)44	9)49	7)46

Study the above exercises until you can give the quotients without hesitation.

Give the quotients with the remainders expressed as fractions.

219. Written Exercises.

Divide the numbers in each column by the numbers above the column.

5, 2	6, 4	7, 3	8, 4
1. 404,535	9. 423,660	17. 354,228	25. 403,224
2. 449,885	10. 364,042	18. 465,962	26. 434,416
3. 439,380	11. 460,632	19. 459,585	27. 443,640
4. 429,340	12. 448,464	20. 394,954	28. 436,280
5. 287,965	13. 183,936	21. 325,255	29. 347,560
6. 478,470	14. 225,870	22. 304,038	30. 178,024
7. 198,395	15. 166,596	23. 254,422	31. 188,000
8. 973,285	16. 103,032	24. 179,282	32. 202,000

220. Solve:

a	*b*	*c*	*d*
$105.25	$374.68	$860.50	$334.57
−$55.50	−$160.69	−$292.68	−$85.79

221. Oral Problems.*

1. How many sheep at $6 each must a farmer sell to pay for 3 tons of hay at $10 a ton?

MODEL for oral recitation: The cost of 3 tons of hay at $10 a ton is $30. To receive $30, the farmer must sell as many sheep as $6 is contained in $30, or 5. He must sell 5 sheep.

MODEL for written recitation:

$10, cost of 1 ton.
× 3
$30, cost of 3 tons.

5, number of sheep.
price of 1 sheep, $6)$30

2. At $4 each, how many sheep must a farmer sell to pay for 3 tons of coal at $8 a ton?

3. How many boxes of berries at 8¢ a box must a boy sell to pay for 4 tablets at 10¢ each?

4. How many pounds of sugar at 6¢ a pound should a woman receive for 3 doz. eggs at 10¢ a dozen?

5. At 8¢ a pound, how many pounds of raisins should be exchanged for 2 lb. of butter at 40¢ a pound?

6. A girl bought 4 yd. of ribbon at 10¢ a yard. She paid for it in berries at 8¢ a box. Find the number of boxes required.

* See note, p. 115.

222. Oral Exercises.

1. How many fourths are there in 1 apple? In 2 apples? In one dollar? In 2 dollars?

2. How many fourths are there in $2\frac{1}{4}$ dollars? In $3\frac{1}{4}$ pies? In $1\frac{3}{4}$ circles? In $5\frac{3}{4}$ dollars?

3. A woman gave each of 12 boys $\frac{1}{4}$ of a pie. How many pies did it take?

4. A man gave each boy $\frac{1}{4}$ of a dollar. He gave the boys $2\frac{1}{4}$ dollars. How many boys were there?

5. In $\frac{1}{2}$ of a pie there are — fourths of a pie.

6. In $\frac{1}{2}$ of a pie and $\frac{1}{4}$ of a pie there are — fourths of a pie.

7. Three dollars are how many quarter dollars?

8. If $\frac{1}{4}$ of the number of boys in a class is 2, how many boys are there in the class?

9. If $\frac{1}{4}$ of the number of girls in a room is 6, how many girls are there in the room?

10. When you know what $\frac{1}{4}$ of a number is, how do you find what the number is?

11. When you know what $\frac{1}{4}$ of a number is, how do you find what $\frac{3}{4}$ of the number is?

12. When you know what $\frac{3}{4}$ of a number is, how do you find what $\frac{1}{4}$ of the number is?

13. There are 16 girls in a class. Find $\frac{1}{4}$ of the number of girls there are in the class. Find $\frac{3}{4}$ of the number of girls there are in the class.

223. Oral Exercises.

1. If an apple is cut into 5 equal parts, what is one of the parts called?

2. In one apple there are — fifths of an apple. In 2 apples there are — fifths of an apple.

3. In $2\frac{2}{5}$ apples there are — fifths apples. In $3\frac{1}{5}$ apples there are — fifths apples.

4. In $3\frac{2}{5}$ apples there are $\frac{x}{5}$ apples. In $2\frac{2}{3}$ apples there are $\frac{x}{3}$ apples. In $4\frac{1}{2}$ apples there are $\frac{x}{2}$ apples.

5. In 4 there are $\frac{x}{5}$. In 5 there are $\frac{x}{5}$. In 4 there are $\frac{x}{3}$.

6. In 3 there are $\frac{x}{4}$. In 5 there are $\frac{x}{3}$. In 6 there are $\frac{x}{3}$.

7. $4\frac{2}{5}=\frac{x}{5}$. $5\frac{2}{3}=\frac{x}{3}$. $7\frac{1}{2}=\frac{x}{2}$. $6\frac{1}{3}=\frac{x}{3}$. $2\frac{3}{5}=\frac{x}{5}$.

8. $\frac{15}{3}=x$. $\frac{12}{4}=x$. $\frac{17}{5}=x$. $\frac{13}{4}=x$.

9. The ratio of 1 to 5 is —. The ratio of 5 to 1 is —.

10. The ratio of 1 to $\frac{1}{5}$ is —. The ratio of $\frac{1}{5}$ to 1 is —.

11. How many 3-inch rulers will a 12-inch ruler make?

12. How many units of $\frac{1}{4}$ ft. are there in 1 ft.?

13. In 1 ft. there are how many units of $\frac{1}{2}$ ft.? Of $\frac{1}{3}$ ft.? Of $\frac{1}{4}$ ft.?

14. Express as whole numbers: $\frac{12}{4}$ in.; $\frac{15}{3}$ ft.

15. Express as thirds: $2\frac{1}{3}$ in.; $4\frac{2}{3}$ ft.; $5\frac{1}{3}$ hr.; $6\frac{2}{3}$ da.

16. If a circle is cut into 6 equal parts, what is one of the parts called?

17. Which is the largest fraction of a circle: $\frac{1}{4}$, $\frac{1}{6}$, or $\frac{1}{2}$ of a circle?

224. Oral Problems.*

1. If 4 chairs cost $16, how much will 3 chairs cost?

MODEL for oral recitation: If 4 chairs cost $16, 1 chair will cost $\frac{1}{4}$ of $16, or $4. Since 1 chair costs $4, 3 chairs will cost 3 times $4, or $12.

MODEL for written recitation:

$4, cost of 1 chair.
4)$16, cost of 4 chairs.

$4, cost of 1 chair.
× 3
$12, cost of 3 chairs.

2. If 4 hats cost $8, how much will 5 hats cost?

3. If 3 tables cost $18, how much will 5 tables cost?

4. If 6 tablets cost 24¢, how much will 4 tablets cost?

5. If 3 lb. of sugar cost 18¢, how much will 2 lb. cost?

6. At the rate of 4 for 20¢, how much will 7 bars of soap cost?

7. A girl bought 4 yd. of ribbon for 24¢. How much would 6 yd. have cost her at the same rate?

8. A boy picked 6 boxes of berries. He sold 2 boxes for 14¢. How much would he have received for 6 boxes at the same rate?

9. George rode 12 mi. in 2 hours. At the same rate, how far would he ride in 5 hours?

* See note, p. 115.

MULTIPLICATION — LESSON I

225. 1. *Memorize the following:*

8	9	8	6	6	7
$\times 6$	$\times 6$	$\times 7$	$\times 8$	$\times 9$	$\times 8$
48	54	56	48	54	56

2. Count by 6's to 54; by 9's to 54.

3. Count by 8's to 56; by 7's to 56.

4. How many days are there in 9 weeks?

5. What is the area of an oblong 8 in. by 7 in.?

6. How many pints are there in 6 gallons?

7. At \$6 a week, how much will a man's board amount to in 9 weeks?

8. What will be the cost of 8 tons of coal at \$7 a ton?

9. A boy earns \$9 each month. How much will he earn in 6 months?

10. At 6 for 1 cent, how many marbles can a boy buy for 8 cents?

11. At 8¢ each, how much will 7 melons cost?

12. A grocer sold raisins at 8¢ a pound. A girl bought 6 lb., and handed the grocer a half-dollar. How much change should she receive?

13. A girl bought 7 yards of lace at 8¢ a yard. She handed the clerk 60¢. How much change should she receive?

14. A boy earns \$10 a month and spends \$3. How much will he save in 8 months?

226. Study Exercises.

8	9	8	6	6	7
6	6	7	8	9	8

Study the above exercises until you can give the products readily.

Give the products from right to left, adding the following numbers to each product: 6, 7, 8, 9.

227. Written Exercises.

1. $789,879 \times 56$	10. $878,787 \times 67$	19. $465,646 \times 89$
2. $879,789 \times 56$	11. $687,867 \times 67$	20. $645,465 \times 89$
3. $687,978 \times 56$	12. $758,578 \times 67$	21. $536,463 \times 89$
4. $968,786 \times 56$	13. $847,687 \times 67$	22. $345,643 \times 89$
5. $759,857 \times 56$	14. $876,543 \times 67$	23. $654,321 \times 89$
6. $847,498 \times 56$	15. $345,678 \times 67$	24. $123,456 \times 89$
7. $938,739 \times 56$	16. $235,786 \times 67$	25. $605,640 \times 89$
8. $782,728 \times 56$	17. $768,547 \times 67$	26. $546,365 \times 89$
9. $975,985 \times 56$	18. $647,835 \times 67$	27. $435,620 \times 89$

228. Written Exercises.

1. Multiply Exercises 1–9 above by 34.
2. Multiply Exercises 10–18 above by 23.
3. Multiply Exercises 19–27 above by 65.

229. Solve:

a	*b*	*c*	*d*	*e*
\$924.37	\$810.35	\$735.41	\$806.31	\$848.12
− \$235.49	− \$316.58	− \$236.46	− \$216.73	− \$250.27

DIVISION — LESSON I

230. 1. *Memorize the following:*

8	9	8	6	6	7
6)48	6)54	7)56	8)48	9)54	8)56

2. What part of 48 is 6? What part of 48 is 8?

3. Eight is what part of 56? Six is what part of 54?

4. What is the ratio of 6 to 54? Of 54 to 6?

5. How many times is the unit \$8 contained in the quantity \$48?

6. If \$48 is divided into 8 equal amounts, how many dollars will there be in each part?

7. If \$9 is the unit that represents the cost of 1 table and \$54 is the quantity that represents the cost of the tables bought, how many tables were bought?

8. A girl spent 56 days with her aunt. How many weeks did she spend with her?

9. A girl spent 48¢ for lace that cost 8¢ a yard. How many yards did she buy?

10. A box containing 6 lb. of raisins was bought for 54¢. How much did the raisins cost per pound?

11. Eight pounds of sugar were bought for 48¢. What was the cost of the sugar per pound?

12. A boy spent 56¢ in 7 weeks. What was the average amount spent each week?

231. Study Exercises.

$6\overline{)48}$	$6\overline{)54}$	$7\overline{)56}$	$8\overline{)48}$	$9\overline{)54}$	$8\overline{)56}$
$6\overline{)49}$	$6\overline{)55}$	$7\overline{)57}$	$8\overline{)49}$	$9\overline{)55}$	$8\overline{)57}$
$6\overline{)50}$	$6\overline{)56}$	$7\overline{)58}$	$8\overline{)50}$	$9\overline{)56}$	$8\overline{)58}$
$6\overline{)51}$	$6\overline{)57}$	$7\overline{)59}$	$8\overline{)51}$	$9\overline{)57}$	$8\overline{)59}$
$6\overline{)52}$	$6\overline{)58}$	$7\overline{)60}$	$8\overline{)52}$	$9\overline{)58}$	$8\overline{)60}$
$6\overline{)53}$	$6\overline{)59}$	$7\overline{)61}$	$8\overline{)53}$	$9\overline{)59}$	$8\overline{)61}$

Study the above exercises until you can give the quotients without hesitation.

Give the quotients and the remainders, if any.

Review Exercise 218, p. 154.

232. Written Exercises.

Use the numbers above the columns as divisors:

	6, 5, 4	7, 6, 4	8, 5, 3	9, 2, 4
	a	*b*	*c*	*d*
1.	484,236	564,942	484,032	544,536
2.	460,830	212,835	449,296	598,887
3.	496,968	549,927	493,328	580,158
4.	503,148	619,766	451,392	482,904
5.	533,262	607,936	373,248	273,834
6.	473,268	337,974	203,720	136,926
7.	496,428	198,695	267,544	122,067
8.	109,110	250,026	133,088	194,868
9.	995,316	117,936	195,696	220,950
10.	218,904	898,352	923,624	597,987

MULTIPLICATION — LESSON J

233. 1. *Memorize the following:*

9	9	8	7	8	9
×7	×8	×8	×9	×9	×9
63	72	64	63	72	81

2. Count by 8's to 72; by 9's to 81.

3. Count by 7's to 63; by 6's to 54.

4. A furniture dealer sold 8 tables at $8 each. How much did he receive for them?

5. What is the area of an oblong 9 inches long and 8 inches wide?

6. What is the area of a flower bed 9 ft. long and 7 ft. wide?

7. At 8¢ a box, how much will 8 boxes of berries cost?

8. What is the sum of nine 9's? Of eight 8's?

9. There are 9 square feet in 1 square yard. How many square feet are there in 8 square yards?

10. A girl bought 9 yards of cloth at 7¢ a yard. She handed the clerk 75¢. How much change should she receive?

11. How many square inches are there in the surface of a piece of paper 8 in. wide and 9 in. long?

12. Find the cost of 7 lb. of raisins at 9¢ a pound.

13. What is the ratio of 8 to 72? Of 9 to 72?

234. Study Exercises.

9	9	8	7	8	9
×7	×8	×8	×9	×9	×9

Study the above exercises until you can give the products without hesitation.

Give the products from right to left, adding the following to each product: 6, 9, 7, 8.

235. Written Exercises.

Multiply the numbers in each column by the following numbers: 89, 67, 45, 32, 30:

	a	*b*	*c*	*d*
1.	987,798	543,435	859,437	163,530
2.	798,978	454,353	627,849	242,607
3.	679,896	345,345	790,486	387,652
4.	867,897	534,354	936,748	559,608
5.	967,898	435,435	382,197	772,002
6.	789,679	253,524	904,382	659,003
7.	986,789	425,342	678,452	870,004
8.	987,698	530,420	987,654	489,603
9.	896,789	315,402	456,789	378,960

236. Solve:

	a	*b*	*c*	*d*	*e*
1.	85,123	96,317	94,164	86,543	74,239
	−47,536	−67,429	−57,369	−18,565	−24,571
2.	68,036	92,228	87,514	83,634	84,410
	−40,068	−65,143	−28,436	−34,057	−47,565

DIVISION — LESSON J

237. 1. *Memorize the following:*

9	9	8	7	8	9
7)63	8)72	8)64	9)63	9)72	9)81

2. What is $\frac{1}{9}$ of \$63? What is $\frac{1}{8}$ of \$72?

3. At 8¢ a box, how many boxes of berries can be bought for 64¢?

4. A boy paid 63¢ for 9 pounds of raisins. How much per pound was this?

5. Nine boys paid for the lemonade for a class picnic. The cost of the lemonade was 81¢. What was each boy's share of the expense?

6. Eight girls gave a party. The expenses amounted to 72¢. What was each girl's share of the expenses?

7. At \$8 each, how many tables can be bought for \$64?

8. What is the unit of measure in Problem 7?

9. Sixty-three trees were set out in 7 rows with the same number of trees in each row. How many trees were set in each row?

10. An oblong containing 72 sq. in. is 9 in. long. How wide is it?

11. How many pounds of candy at 9¢ a pound can be bought for 72¢?

238. Study Exercises.

$7\overline{)63}$	$8\overline{)72}$	$8\overline{)64}$	$9\overline{)63}$	$9\overline{)72}$	$9\overline{)81}$
$7\overline{)64}$	$8\overline{)73}$	$8\overline{)65}$	$9\overline{)64}$	$9\overline{)73}$	$9\overline{)82}$
$7\overline{)65}$	$8\overline{)74}$	$8\overline{)66}$	$9\overline{)65}$	$9\overline{)74}$	$9\overline{)83}$
$7\overline{)66}$	$8\overline{)75}$	$8\overline{)67}$	$9\overline{)66}$	$9\overline{)75}$	$9\overline{)84}$

Study the above until you can give the quotients without hesitation.

Give the quotients and remainders, if any.

Give the quotients with the remainders expressed as fractions.

Increase the dividends in each of the above columns until each divisor is contained in the dividend 10 times.

Review Exercises 218 and 231.

239. Written Exercises.

Use the numbers above the columns as divisors:

	a	*b*	*c*	*d*
	7, 5	8, 6, 4	3, 9, 2	4, 5
1.	635,649	726,456	978,560	322,789
2.	213,542	324,048	384,271	263,867
3.	714,644	241,632	567,894	545,982
4.	286,573	738,768	306,752	756,789
5.	698,572	516,976	983,084	295,837
6.	678,573	206,344	542,301	106,967
7.	599,186	767,592	894,517	408,432
8.	608,033	769,896	675,214	702,002

240. Oral Problems.*

1. If 4 chairs cost $12, how many chairs can be bought for $21?

MODEL for oral recitation: If 4 chairs cost $12, 1 chair will cost $\frac{1}{4}$ of $12, or $3. If 1 chair costs $3, as many chairs can be bought for $21 as there are $3 in $21, or 7. 7 chairs can be bought for $21.

MODEL for written recitation:

$3; cost of 1 chair.
4)$12, cost of 4 chairs.

7 chairs for $21.
cost of 1 chair, $3)$21

2. If 3 tables cost $18, how many tables can be bought for $30?

3. If 2 tons of coal cost $14, how many tons can be bought for $28?

4. How many yards of ribbon can be bought for 20¢, if 3 yd. cost 12¢?

5. How many tablets can be bought for 40¢, if 3 tablets cost 24¢?

6. At the rate of 3 boxes for 18¢, how many boxes of berries can be bought for 36¢?

7. How many pencils can be bought for 24¢, if 3 pencils cost 9¢?

8. If Alice uses 6 lemons to make 2 pies, how many pies will a dozen lemons make?

* See note, p. 115.

241. Oral Problems.

Give the analysis for each:

1. How much will 4 trunks cost at $7 each?

2. A boy bought 36¢ worth of sugar at 6¢ a pound. How many pounds did he buy?

3. A grocer sold 6 qt. of berries at 8¢ a quart. How much did he receive for them?

4. If 6 pairs of shoes cost $18, what is the cost of 4 pairs of shoes?

5. How many desks can be bought for $32, if 6 desks cost $24?

6. How far will a boy ride in 8 hours, if he travels at the rate of 12 miles in 3 hours?

7. If 5 apples cost 10¢, how much will 8 apples cost at the same rate?

8. If 4 bunches of firecrackers cost 20¢, how much will 6 bunches cost at the same rate?

9. How many sacks of potatoes at $2 a sack will pay for 4 tons of coal at $6 a ton?

10. If it takes a boy 12 minutes to ride $\frac{3}{4}$ of a mile, how long, at the same rate, will it take him to ride a mile?

11. If it takes 2 men 1 day to build a fence, in what time can 1 man build it?

12. If an acre of land is worth $45, how much is $\frac{3}{5}$ of an acre worth at the same rate?

13. A grocer sold $\frac{4}{5}$ of a box of apples for 40¢. How much was the box worth at the same rate?

242. Written Problems.

1. A farmer had 360 acres of land. He sold $\frac{3}{4}$ of it at $60 an acre. How much did he receive for it?

2. A man sold $\frac{2}{3}$ of his farm for $4200. What, at the same rate, was the value of the farm?

3. A boy had $36 in a bank. He drew out $\frac{3}{4}$ of it to pay for a bicycle. How much did the bicycle cost him?

4. In an orchard containing 480 trees $\frac{3}{5}$ of the trees are orange trees and the remainder are lemon trees. Find how many of each kind there are in the orchard.

5. A farmer sold 3 cows for $45 each and 2 horses for $130 each. He deposited in a bank $\frac{4}{5}$ of the money received. Find the amount of his deposit.

6. A man bought 8 horses at an average cost of $79. He sold them all for $760. How much did he make on them? Find the average amount made on each horse.

7. A man bought 9 cows for $225 and sold them for $315. How much did he make on them? Find the average amount made on each cow.

8. A farmer sold 360 sacks of potatoes, which was $\frac{4}{5}$ of his entire crop, at $2 a sack. What was the value of his entire crop at the same rate?

9. How many weeks must a boy work at $3 a week to pay for a suit of clothes that costs $12?

243. Drill Exercises.

Give quotients with the remainders expressed as fractions:

1. $\frac{32}{4}, \frac{36}{4}, \frac{35}{5}$.
2. $\frac{40}{5}, \frac{32}{4}, \frac{36}{6}$.
3. $\frac{45}{9}, \frac{40}{8}, \frac{48}{6}$.
4. $\frac{63}{7}, \frac{72}{9}, \frac{56}{8}$.
5. $\frac{54}{6}, \frac{42}{7}, \frac{64}{8}$.
6. $\frac{35}{7}, \frac{72}{8}, \frac{63}{9}$.
7. $\frac{56}{6}, \frac{50}{8}, \frac{59}{7}$.
8. $\frac{57}{7}, \frac{75}{9}, \frac{68}{8}$.
9. $\frac{85}{9}, \frac{43}{5}, \frac{50}{6}$.
10. $\frac{75}{8}, \frac{38}{5}, \frac{40}{7}$.
11. $\frac{39}{6}, \frac{45}{7}, \frac{87}{9}$.
12. $\frac{80}{8}, \frac{76}{9}, \frac{44}{5}$.
13. $\frac{47}{6}, \frac{64}{7}, \frac{30}{8}$.
14. $\frac{50}{7}, \frac{34}{4}, \frac{47}{7}$.
15. $\frac{19}{5}, \frac{70}{7}, \frac{28}{6}$.
16. $\frac{54}{7}, \frac{56}{9}, \frac{70}{8}$.
17. $\frac{37}{5}, \frac{17}{6}, \frac{28}{8}$.
18. $\frac{25}{7}, \frac{11}{6}, \frac{30}{3}$.

244. Oral Exercises.

Add each column as indicated in Step C, p. 49.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*
6	8	3	6	8	3	8	2	8	3	4	4	3
3	4	2	2	4	6	4	3	7	9	2	8	9
2	5	3	2	5	8	9	4	6	7	3	5	7
6	8	9	6	8	3	5	5	5	2	7	4	5
3	6	2	2	4	6	6	6	4	3	2	2	2
2	4	3	2	5	4	8	7	3	6	5	3	4
6	5	7	7	3	3	3	8	2	4	3	8	8
8	8	9	8	7	2	7	9	1	7	4	9	3

Two addends whose sum is ten or less may be taken as one number.

Exercise *a* above may be added: 14, 19, 27, 36.

It may also be added: 16, 25, 30, 36.

Add the above exercises in a similar manner.

245. Written Problems.

1. A man bought 9 horses for $945 and sold them for $125 each. Find the amount of his gain or loss. What was the average gain or loss on each horse?

2. A grocer bought 6 barrels of apples at $3.25 per barrel and sold them all for $25. Find the amount of his gain or loss.

3. A farm of 189 acres was bought for $65 an acre and sold for $80 an acre. Find the gain per acre. Find the gain on the entire farm.

4. A hardware merchant sold stoves at $9 each. During the year he sold $405 worth of stoves. How many stoves did he sell? His profit was $2 on each stove sold. How much did he make on the sale of stoves during the year?

5. A man sold $\frac{3}{5}$ of his farm for $3600. What part of his farm was left? At the same rate, what was the value of the part that was left? What was the value of the entire farm?

6. A harness cost $30. This was $\frac{2}{5}$ of the cost of the buggy. Find the cost of the buggy. The harness and buggy together cost $\frac{1}{2}$ of the cost of the horse. Find the cost of the horse. Find the cost of all three.

7. A man had 288 miles to travel. He rode $\frac{2}{9}$ of the distance on his wheel and the remainder on a train. How far did he ride on each?

MULTIPLICATION—LESSON K

246. Oral Exercises.

7	75	64	70	354	100
$\times 10$	$\times 10$	$\times 10$	$\times 10$	$\times 10$	$\times 10$
70	750	640	700	3540	1000

1. Compare the products in the above exercises with the multiplicands. How do they differ?

2. Can you give a short method of multiplying a number by 10?

3. Multiply each of the following numbers by 10: 34, 45, 8, 90, 11, 12, 524, 670, 200.

4. Can you give a short method of multiplying a number by 100?

5. Multiply each of the numbers in Problem 3 by 100.

6. Each of the following numbers is 10 times what number: 60, 80, 90, 950, 100, 300, 760, 7600?

7. Each of the following numbers is 100 times what number: 600, 100, 5000, 3700, 9500, 85,000?

8. Divide each of the following numbers by 10: 80, 110, 210, 340, 450, 6050.

9. Give a short method of dividing a number that ends in zero by 10.

10. A number that does not end in zero may be divided by 10 thus: $85 \div 10$ is 8.5. A point called a **decimal point** is placed before the right-hand figure of the number. This divides it by 10. The answer is read, *eight and five tenths*. It is the same as $8\frac{5}{10}$.

MULTIPLICATION — LESSON L

247. Oral Exercises.

3	4	5	6	11	11
× 11	× 11	× 11	× 11	× 4	× 6
33	44	55	66	44	66

Study these exercises to find a short way of multiplying any number from 1 to 9 by 11. Multiply by 11: 8, 7, 4, 3, 1, 2, 9, 6, 5.

Multiply 11 by each of the above numbers.

MULTIPLICATION — LESSON M

248. Oral Exercises.

1. The number 12 is used in many of our measurements. There are 12 inches in 1 foot; there are 12 months in 1 year; there are 12 things in 1 dozen; and the clock face is divided into 12 parts. Twelve dozen things are sometimes put together and called a *gross*. Is there a gross of crayon in a full box?

2. *Memorize:*

12	12	12	12	12
× 3	× 4	× 5	× 6	× 7
36	48	60	72	84
12	12	12	12	12
× 8	× 9	× 10	× 11	× 12
96	108	120	132	144

3. How many oranges are 5 doz. oranges?

4. How many months are 9 years? 12 years?

249. Table of Products and Quotients.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

LONG MEASURE *

250. Distance is measured in inches, feet, yards, rods, and miles. The yard is the standard unit of length. The other units are derived from it.

251. *Memorize:*

12 inches (in.) = 1 foot (ft.)

3 feet = 1 yard (yd.)

$5\frac{1}{2}$ yards, or $16\frac{1}{2}$ feet = 1 rod (rd.)

320 rods = 1 mile (mi.)

1 mile = 1760 yd. = 5280 ft.

* Review Exercise 149, p. 114.

SQUARE MEASURE

252. 1. Using a yardstick, draw on the blackboard a square whose side is one yard. This is a **square yard.**

2. Using a foot rule, draw a square whose side is one foot. What is this square called?

3. Divide the square yard into square feet. How many square feet are there in one square yard?

4. Draw a square inch. Divide a square foot into square inches. How many square inches are there in one square foot? $12 \times 12 = —$.

5. Measure on the ground a square whose side is one rod. Drive a stake at each corner of it. This is called a —.

6. It takes 160 square rods to make one acre. A piece of land 16 rd. long and 10 rd. wide is one acre. A piece of land 20 rd. long and — rd. wide is one acre.*

7. A piece of land one mile square contains 640 acres. This is called a **section.**

253. *Memorize:*

144 square inches (sq. in.)	= 1 square foot (sq. ft.)
9 square feet	= 1 square yard (sq. yd.)
$30\frac{1}{4}$ square yards	= 1 square rod (sq. rd.)
160 square rods	= 1 acre (A.)
640 acres	= 1 square mile (sq. mi.)

* If feasible, have the children measure off one acre on the school grounds or in an adjoining field.

254. Written Problems.

1. Find the number of square feet in a walk 50 ft. long and 4 ft. wide.

2. How much will it cost at $.12 a square foot to lay a cement walk 50 ft. long and 5 ft. wide?

3. Find the area of a walk 60 ft. long and 5 ft. wide.

4. How many square inches are there in 3 sq. ft.? In $3\frac{1}{2}$ sq. ft.?

5. How many square inches are there in 3 sq. ft. and 32 sq. in.?

6. Find the number of square feet there are on the floor of your schoolroom.

7. Find the number of square rods there are in your school yard.

8. Find the number of square yards of blackboard there are in your schoolroom.

9. How much did the blackboard in your schoolroom cost at 18¢ a square foot?

255. In your drawings, let 1 in. represent 2 ft.

Draw:

1. A square that will contain 16 sq. ft.

2. A rectangle that will contain 16 sq. ft.

3. A square that will contain 36 sq. ft.

4. A rectangle that will contain 36 sq. ft.

5. Find the perimeter of each of your figures.

BILLS AND ACCOUNTS

256. 1. Study the bill given in Sec. 78, p. 82.

2. A bill must always show the date of the transaction. What is the date of the transaction referred to in the bill in Sec. 78?

3. The **debtor** is the party who buys the goods. Who is the debtor in the bill referred to above?

4. The **creditor** is the party who sells the goods. Who is the creditor in the bill referred to above?

5. An **item** is a separate debit or credit made in a bill. How many items are there in the bill referred to above?

6. How many items are there in the bill in Sec. 257?

7. Name the debtor and the creditor in the bill in Sec. 257.

257. A RECEIPTED BILL

OAKLAND, Cal., June 30, 1904.

HENRY LOVE,

Bought of JAMES ROLAND.

5 lb. sugar	.05		.25		
2 cans tomatoes	.10		.20		
2 lb. coffee	.40		.80	$1	25
Received Payment, JAMES ROLAND.					

Make similar bills, using regular bill paper.

LONG DIVISION

258. When all the steps in division are written, the process is called **long division.**

Divide 173 by 3.

MODEL:
$$\begin{array}{r} 57\frac{2}{3} \\ 3\overline{)173} \\ 15 \\ \hline 23 \\ 21 \\ \hline 2 \end{array}$$

3 is contained in 17 five times. Write 5 in the quotient above the 7, as in short division. Multiply 3 by 5 and write the product under 17, and subtract. The remainder is 2. Bring down the 3 of the dividend and find how many times 3 is contained in 23. This is 7 times. Multiply 3 by 7 and write the product under 23, and subtract. Treat the remainder as in short division.

CASE ONE

259. When the second figure* of the divisor is the same as or less than the first figure, as in 44, 63, 978, 658, etc.

1. Divide 2292 by 43.

First, find how many places at the left of 2292 it will take to contain 43 at least one time. It will take three places. The first figure of the quotient will be in tens' place.

MODEL:
$$\begin{array}{r} 53\frac{13}{43} \\ 43\overline{)2292} \\ 215 \\ \hline 142 \\ 129 \\ \hline 13 \end{array}$$

Step 1. 4 is contained in 22 five times with 2 remainder. This remainder, with the next figure of the dividend, is the dividend of 3, the second figure of the divisor. The dividend of

* In 63 regard 6 as the first figure and 3 as the second figure.

3 is 29. Is 3 contained in 29 *as many as* 5 times? If it is, 5 is the *trial quotient figure*. 3 is contained in 29 *as many as* 5 times. Write 5 in the quotient above 9.

Step 2. Multiply 43 by 5, and write the product under 229.

Step 3. Subtract 215 from 229. The remainder is 14.

As this remainder is less than the divisor, the trial quotient figure is the true quotient figure.

Step 4. Bring down the next figure of the dividend. The new dividend is 142. Repeat Step 1. 4 is contained in 14 three times with 2 remainder. As 3 is contained in 22 *as many as* 3 times, 3 is the *trial quotient figure*. Write 3 in the quotient.

Repeat Step 2. Multiply 43 by 3 and write the product under 142.

Repeat Step 3. Subtract 129 from 142. The remainder is 13. Treat the remainder as in short division.

2. Divide 1806 by 43; 7877 by 96; 7877 by 82.

3. Divide 2806 by 65; 5927 by 97; 5927 by 51.

4. Divide 16,108 by 72; 18,191 by 85; 45,960 by 71.

5. Divide 2115 by 43.

First, find how many places at the left of 2115 it will take to contain 43 at least one time.

MODEL:

$$\begin{array}{r} 49\tfrac{8}{43} \\ 43\overline{)2115} \\ 172 \\ \hline 395 \\ 387 \\ \hline 8 \end{array}$$

Step 1. 4 is contained in 21 five times with 1 remainder. As 3 is not contained in 11 as many as 5 times, write 4 as the trial quotient figure, and continue as in the preceding exercise.

6. Divide 6748 by 76; 8432 by 54; 7667 by 99.

7. Divide 4084 by 72; 2094 by 93; 6456 by 77.

8. Divide 1243 by 22; 4527 by 33; 5468 by 76.

9. Divide 9247 by 95.

MODEL: $95\overline{)9247}^{\,9}$ — 9 is contained in 92 ten times. Use 9 as the trial quotient figure. Complete the division.

10. Divide 7492 by 77; 6230 by 65; 9348 by 98.

11. Divide 6258 by 66; 5213 by 55; 8570 by 87.

12. Divide 5234 by 54; 7485 by 76; 8775 by 88.

260. *When the second figure of the divisor is the same as or less than the first figure, the trial quotient figure may be found as follows:*

1. *If the second figure of the divisor is contained in its dividend* as many times as the first figure is contained in its dividend, use this quotient figure as the trial quotient figure.*

2. *If the second figure of the divisor is not contained in its dividend as many times as the first figure is contained in its dividend, use as a trial quotient figure one less than the quotient figure obtained by dividing by the first figure of the divisor. This will be found to be the true quotient figure.*

3. *If the first figure of the divisor is contained in its dividend* 10 *times, use* 9 *as the trial quotient figure.*†

* The number formed by annexing the next figure of the dividend to the remainder left after dividing by the first figure of the divisor is the dividend of the second figure of the divisor.

† The pupils should become perfectly familiar with these facts through illustration.

With divisors of two places, the trial quotient figure obtained as indicated in 1 and 3 will be found to be the true quotient figure. Often with divisors of more than two places, the trial quotient figure will be found to be one more than the true quotient figure.

261. Written Exercises.

Examine the divisors used in these exercises.

Divide:

1. 51,913 by 54.
2. 65,760 by 87.
3. 51,596 by 92.
4. 61,640 by 76.
5. 51,594 by 96.
6. 83,756 by 43.
7. 98,765 by 21.
8. 45,637 by 86.
9. 94,245 by 73.
10. 87,653 by 54.
11. 67,321 by 95.
12. 86,734 by 85.
13. 67,863 by 75.
14. 54,326 by 64.
15. 92,147 by 53.
16. 92,147 by 534.
17. 54,326 by 647.
18. 94,245 by 736.
19. 67,863 by 754.
20. 67,321 by 959.
21. 51,504 by 967.
22. 45,637 by 865.

262. Written Exercises.

Examine each divisor before using it.

Divide each of the following by 87, 94, 63, 72, 55, 22, 31, 44, 33, 652, 773, 940:

1. 93,456.
2. 67,342.
3. 54,943.
4. 86,425.
5. 19,831.
6. 24,753.
7. 40,572.
8. 98,345.

263. Written Problems.

1. There are 52 weeks in one year. How many years are there in 468 weeks?

2. A man bought a carload of cattle at $32 each. He paid $800 for the carload. Find the number of cattle in the car.

3. A train travels at an average speed of 42 mi. an hour. How many hours will it take it to travel 1000 mi.?

4. A hardware merchant paid $21 each for stoves. The amount of his bill was $315. How many stoves did he buy?

5. A dealer bought a carload of horses at $95 each. He paid $2565 for them. How many horses did he buy?

6. A merchant paid $3570 for some carriages at $210 each. How many carriages did he buy?

7. At $65 a month, in how many months will a clerk earn $975?

8. At 55¢ a yard, how many yards of cloth can be bought for $8.25? (Change to cents.)

9. At 75¢ each, how many tickets must be sold to amount to $15?

10. There were 42 children at a school picnic. The expenses of the picnic were $10.50. Find each one's share of the expenses.

CASE TWO

264. When the second figure of the divisor is greater than the first figure, as in 37, 28, 287, 596, etc.

Divide 1734 by 47.

MODEL: $47\overline{)1734}$ (3)

When the divisor is 47, 48, or 49, use 5 as the divisor to find the trial quotient figure. 5 is contained in 17 three times. Use 3 as the trial quotient figure. Complete the division.

When the second figure of the divisor is 7, 8, *or* 9, *the number to be used as a divisor to find the trial quotient figure is determined as follows:*

When the divisor is 47, 48, 49, 475, *etc., use* 5 *as a divisor. When the divisor is* 57, 58, 59, 584, *etc., use* 6 *as a divisor.*

The trial quotient figure thus obtained is sometimes one more or one less than the true quotient figure.

265. Written Exercises.

Before dividing, state what divisor will be used to find the trial quotient figure in each of the following.

Divide:

1. 54,321 by 19.
2. 54,796 by 38.
3. 12,345 by 69.
4. 43,697 by 28.
5. 43,345 by 18.
6. 54,678 by 57.
7. 71,067 by 38.
8. 30,402 by 49.
9. 42,796 by 59.
10. 74,908 by 67.
11. 43,768 by 57.
12. 67,098 by 19.
13. 43,907 by 275.
14. 69,087 by 594.
15. 87,906 by 178.
16. 38,690 by 576.
17. 43,234 by 374.
18. 41,908 by 490.

266. Divide 1085 by 25.

MODEL: $25\overline{)1065}^{\,4}$

2 is contained in 10 five times. Use one less than this quotient as a trial quotient figure. 4 is the trial quotient figure. Complete the division.

When 23–26, 34–36, 45, 46, *and* 56 *are used as divisors, or as the first two figures of divisors, use as a trial quotient figure one less than the quotient obtained by dividing the first figure, or figures, of the dividend by the first figure of the divisor.*

The trial quotient figure thus obtained is sometimes one more or one less than the true quotient figure.

267. Written Exercises.

Divide each by 25, 35, 46, 56, 243, 462, and 358:

1. 9875.	7. 9356.	13. 6532.	19. 9530.
2. 2675.	8. 3640.	14. 3256.	20. 4780.
3. 3650.	9. 1884.	15. 7890.	21. 8020.
4. 4563.	10. 3657.	16. 5231.	22. 6510.
5. 1895.	11. 7627.	17. 6423.	23. 1560.
6. 2750.	12. 1840.	18. 5768.	24. 7090.

268. Written Exercises.

Divide each by 65, 49, 36, 245, and 684:

1. 547,659.	5. 634,237.	9. 120,500.
2. 134,652.	6. 845,178.	10. 387,945.
3. 347,865.	7. 342,156.	11. 674,109.
4. 937,311.	8. 240,100.	12. 832,674.

269. When such numbers as 13, 14, 15, 16, 134, 149, 157, etc., are used as divisors, the trial quotient figure can not be determined by any definite rule; but by the following method a trial quotient figure may be found that will seldom vary more than one from the true quotient figure.

Divide 1067 by 14.

MODEL: $14\overline{)1067}^{\,7}$

Use 2 as a divisor. 2 is contained in 10 five times. Add 2 to this quotient for a trial quotient figure. 7 is the trial quotient figure. Complete the division.

When 13, 14, 15, 16, 138, *etc., are used as divisors, divide the first figure, or the first two figures, of the dividend by* 2, *and add* 2 *to the quotient thus obtained for a trial quotient figure, unless the quotient figure can be determined readily by inspection.*

270. Written Exercises.

Divide:

1. 95,478 by 15.
2. 87,345 by 14.
3. 11,745 by 16.
4. 10,000 by 13.
5. 20,348 by 14.
6. 13,468 by 16.
7. 23,410 by 15.
8. 46,098 by 13.
9. 10,710 by 14.
10. 12,000 by 15.
11. 84,675 by 138.
12. 12,432 by 146.
13. 90,543 by 164.
14. 14,500 by 159.
15. 15,234 by 163.

271. Written Exercises.

Divide each by 95, 79, 36, 16, 425, 386, and 145:

1. 548,674.
2. 427,658.
3. 240,575.
4. 318,925.
5. 450,100.
6. 987,689.

272. Written Exercises.

Divide:

1. 25,678 by 38.
2. 17,408 by 19.
3. 62,389 by 83.
4. 37,896 by 52.
5. 51,678 by 57.
6. 23,670 by 15.
7. 10,682 by 14.
8. 25,678 by 38.
9. 17,408 by 27.
10. 62,389 by 88.
11. 37,896 by 376.
12. 51,678 by 645.
13. 10,682 by 210.
14. 12,367 by 144.
15. 98,765 by 990.

16. There are 5280 ft. in one mile. Reduce 5,786,968 ft. to miles.

17. There are 365 da. in one year. Reduce 63,475 da. to years.

18. At 15¢ a gallon, how many gallons of oil can be bought for $4.50?

19. A bushel of wheat weighs 60 lb. A cental is 100 lb. How many bushels are there in 18 centals of wheat?

20. A barrel of flour contains 196 lb. How many barrels can be filled from 6272 lb. of flour?

21. At $75 an acre, how many acres of land can be bought for $3000?

22. If a man saves $45 a month, in how many months will he save enough to buy a farm worth $3150?

23. There are 144 sq. in. in one square foot. Reduce 11,520 sq. in. to square feet.

24. There are 320 rd. in one mile. Reduce 1920 rd. to miles.

273. Written Problems.

1. A farmer planted an orchard of 240 trees. There were 24 trees in each row. How many rows were there in the orchard?

2. Find the cost of 26 cans of oil at $1.10 a can.

3. A trader paid 22¢ a dozen for eggs. He bought $8.80 worth. How many dozen did he buy?

4. A car made 8 trips in a day. On an average the car carried 85 people each trip. The fare was 5¢. What were the total receipts for the day?

5. If school is in session 5 hours a day for 200 days in the year, how many hours of school are there in a year?

6. A boy's salary is $20 a month. He has been paid $120. How many months has he worked?

7. A boy puts $8 in a bank each month he works. He has $176 in the bank. How many months has he been working?

8. A farmer sold his hay at $9 a ton. He received for his crop $1800. How many tons of hay did he sell?

9. A farmer sold his wheat at $.85 a bushel. He sold 78 bushels. How much did he receive for his wheat?

10. A merchant buys flour at $5 a barrel and sells it at $6. How much does he gain on each barrel? $1 is what part of $5?

11. A boy bought 30 papers at the rate of 2 for 5¢. He sold 25 of them at 5¢ apiece. The other 5 he gave away. Did he gain or lose, and how much?

CHAPTER V

FRACTIONS AND DECIMALS

COMPOUND NUMBERS AND REVIEWS

ADDITION OF FRACTIONS

274. Written Exercises.

One boy and 1 boy and 1 boy are — boys.

One half and one half and one half are — halves.

$\frac{3}{2}$ are equal to — $\frac{1}{2}$.

Add: $4\frac{1}{2}$, $2\frac{1}{2}$, $2\frac{1}{2}$, $9\frac{1}{2}$. Add the fractions first: $\frac{1}{2}+\frac{1}{2}+\frac{1}{2}$ are $\frac{3}{2}$, which are equal to $1\frac{1}{2}$. Write the $\frac{1}{2}$ under the column of fractions and add the 1 to the column of whole numbers.

275. Add the following:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
$5\frac{1}{2}$	8	9	$4\frac{1}{2}$	7	$7\frac{1}{2}$	7	$8\frac{1}{2}$	$6\frac{1}{2}$
$7\frac{1}{2}$	5	8	$5\frac{1}{2}$	$6\frac{1}{2}$	6	$5\frac{1}{2}$	6	$5\frac{1}{2}$
$6\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$9\frac{1}{2}$	9	$6\frac{1}{2}$	2	$8\frac{1}{2}$
9	$6\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	8	$8\frac{1}{2}$	9	$7\frac{1}{2}$	$9\frac{1}{2}$

276.* 1. Find by addition the cost of 5 yards of cloth at $4\frac{1}{2}$¢ a yard.

2. How far is it around an oblong that is $8\frac{1}{2}$ in. long and $5\frac{1}{2}$ in. wide? Draw the oblong.

* Dictate additional problems of a similar character.

277. Written Exercises.

Review Exercise 90, p. 88.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
$4\frac{1}{2}$	$3\frac{1}{3}$	$4\frac{1}{3}$	$4\frac{1}{2}$	$4\frac{2}{3}$	$6\frac{1}{2}$	$4\frac{2}{3}$	$7\frac{2}{3}$
$5\frac{1}{2}$	$5\frac{1}{3}$	$5\frac{2}{3}$	6	$6\frac{2}{3}$	$5\frac{1}{2}$	$8\frac{1}{3}$	$9\frac{1}{3}$
$6\frac{1}{2}$	$7\frac{1}{3}$	6	7	$5\frac{2}{3}$	5	$9\frac{1}{3}$	$8\frac{1}{3}$
$3\frac{1}{2}$	$6\frac{1}{3}$	$7\frac{2}{3}$	$8\frac{1}{2}$	$4\frac{2}{3}$	6	$8\frac{1}{3}$	$7\frac{1}{3}$
$4\frac{1}{2}$	$8\frac{1}{3}$	8	$9\frac{1}{2}$	$4\frac{2}{3}$	$7\frac{1}{2}$	$5\frac{2}{3}$	$8\frac{1}{3}$
2	$3\frac{1}{3}$	9	6	$3\frac{2}{3}$	8	6	$7\frac{1}{3}$

1. Find by addition the distance around a room that is $4\frac{2}{3}$ yd. long and $3\frac{1}{3}$ yd. wide.

2. Find by addition the cost of 6 yd. of cloth at $5\frac{2}{3}$¢ a yard.

SUBTRACTION OF FRACTIONS

278. Written Exercises.

1. Subtract $2\frac{1}{2}$ from $4\frac{1}{2}$.

MODEL:

$4\frac{1}{2}$ $\frac{1}{2}$ and 0 make $\frac{1}{2}$.

$-2\frac{1}{2}$

2 2 and 2 make 4.

2. Subtract 2 from $5\frac{1}{2}$.

MODEL:

$5\frac{1}{2}$ 0 and $\frac{1}{2}$ make $\frac{1}{2}$.

-2

$3\frac{1}{2}$ 2 and 3 make 5.

Solve:

3.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
$4\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$4\frac{2}{3}$	$4\frac{2}{3}$	$4\frac{2}{3}$	$7\frac{1}{2}$	$5\frac{2}{3}$	$7\frac{2}{3}$
$-2\frac{1}{2}$	-2	$-3\frac{1}{2}$	$-2\frac{1}{3}$	$-3\frac{1}{3}$	$-2\frac{2}{3}$	$-2\frac{1}{2}$	$-3\frac{1}{3}$	$-3\frac{1}{3}$

4.

a	*b*	*c*	*d*	*e*	*f*	*g*
$14\frac{2}{3}$	$23\frac{1}{2}$	$24\frac{2}{3}$	$26\frac{1}{3}$	$30\frac{1}{2}$	$40\frac{1}{2}$	$45\frac{2}{3}$
$-6\frac{1}{3}$	-18	$-18\frac{1}{3}$	-9	$-16\frac{1}{2}$	-10	$-28\frac{1}{3}$

5. Find the sum of each of the above exercises.

279. Written Exercises.

1. From 27 subtract $13\frac{1}{2}$.

MODEL: $27 - 13\frac{1}{2} = 13\frac{1}{2}$

Add $\frac{2}{2}$ to the minuend. $\frac{1}{2}$ and $\frac{1}{2}$ are $\frac{2}{2}$. Add 1 to 3. 4 and 3 are 7. 1 and 1 = 2.

Subtract:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
2.	4	5	8	6	3	10	25	15	24
	$2\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{1}{2}$	$4\frac{1}{2}$	$12\frac{1}{2}$	$8\frac{1}{2}$	$20\frac{1}{2}$

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
3.	5	7	10	8	8	9	25	34
	$2\frac{1}{3}$	$4\frac{1}{3}$	$3\frac{1}{3}$	$6\frac{1}{3}$	$3\frac{2}{3}$	$4\frac{2}{3}$	$12\frac{2}{3}$	$15\frac{1}{3}$

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
4.	35	37	67	34	30	40	30	40
	$28\frac{2}{3}$	$9\frac{1}{2}$	$18\frac{2}{3}$	$10\frac{1}{2}$	$10\frac{1}{2}$	$20\frac{2}{3}$	$10\frac{2}{3}$	$19\frac{2}{3}$

5. A woman bought 8 yd. of cloth. She used $2\frac{1}{2}$ yd. in making a waist. How much of the cloth had she left?

6. A grocer bought 9 doz. eggs. He sold $5\frac{1}{2}$ dozen. How many dozen did he have left?

7. A girl bought 10 yards of lace. She used $3\frac{2}{3}$ yards to trim a dress. How many yards had she left?

8. A girl bought 2 pieces of ribbon. One of the pieces was $6\frac{1}{2}$ yards long and the other was $4\frac{1}{2}$ yards long. How many yards were there in the two ribbons?

280. Written Exercises.

1. From $9\frac{1}{3}$ subtract $4\frac{2}{3}$.

MODEL: $9\frac{1}{3}$ / $-4\frac{2}{3}$ / $4\frac{2}{3}$

Since the fraction in the minuend is less than the fraction in the subtrahend, add $\frac{3}{3}$ or 1 to the fraction of the minuend. $\frac{2}{3}$ and $\frac{2}{3}$ are $\frac{4}{3}$. Add 1 to 4. 5 and 4 are 9.*

	a	*b*	*c*	*d*	*e*	*f*	*g*
2.	$9\frac{1}{3}$	$7\frac{1}{3}$	$8\frac{1}{3}$	$14\frac{1}{3}$	$22\frac{1}{3}$	$34\frac{1}{3}$	$40\frac{1}{3}$
	$-4\frac{2}{3}$	$-2\frac{2}{3}$	$-6\frac{2}{3}$	$-4\frac{2}{3}$	$-15\frac{2}{3}$	$-17\frac{2}{3}$	$-10\frac{2}{3}$
3.	$9\frac{2}{3}$	$7\frac{2}{3}$	$8\frac{2}{3}$	$12\frac{1}{2}$	$27\frac{1}{3}$	$34\frac{1}{3}$	$17\frac{1}{3}$
	$-4\frac{1}{3}$	$-2\frac{1}{3}$	$-4\frac{2}{3}$	$-3\frac{1}{2}$	-18	$-26\frac{2}{3}$	$-9\frac{2}{3}$

4. Find the sum of each of the above exercises.

5. From a piece of cloth containing $7\frac{1}{3}$ yd. of silk a merchant sold $3\frac{2}{3}$ yd. How many yards remained?

6. A grocer bought 36 doz. eggs. He sold $4\frac{1}{3}$ doz. to one customer and $3\frac{2}{3}$ doz. to another. How many dozen did he sell to both?

7. A girl bought $6\frac{1}{3}$ yd. of lace. She used $2\frac{2}{3}$ yd. to trim a dress. How much lace had she left?

* After the pupils have become familiar with this method, they may be taught to subtract the fraction of the subtrahend from 1, and to add the difference to the fraction in the minuend, thus: $\frac{2}{3}$ and $\frac{1}{3}$ make 1. $\frac{1}{3}$ (the difference) and $\frac{1}{3}$ (the fraction in the minuend) make $\frac{2}{3}$, the fractional part of the answer.

281. Written Exercises.

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	$5\frac{1}{3}$	$6\frac{3}{4}$	$6\frac{1}{2}$	$5\frac{3}{4}$	$6\frac{1}{3}$	$5\frac{1}{2}$	$6\frac{3}{4}$	$4\frac{1}{3}$
	$7\frac{2}{3}$	$2\frac{1}{4}$	$5\frac{1}{2}$	$2\frac{3}{4}$	$7\frac{2}{3}$	$8\frac{1}{2}$	$5\frac{1}{4}$	5
	$6\frac{1}{3}$	$8\frac{2}{4}$	2	$8\frac{3}{4}$	$8\frac{2}{3}$	$9\frac{1}{2}$	8	$9\frac{2}{3}$
	$8\frac{1}{3}$	$5\frac{3}{4}$	4	$9\frac{3}{4}$	$7\frac{1}{3}$	7	$9\frac{3}{4}$	$8\frac{2}{3}$
2.	$5\frac{4}{5}$	$6\frac{2}{3}$	$6\frac{1}{5}$	$8\frac{1}{4}$	$5\frac{2}{3}$	$6\frac{2}{5}$	$5\frac{1}{4}$	$9\frac{3}{4}$
	$6\frac{3}{5}$	$3\frac{1}{3}$	$2\frac{2}{5}$	$5\frac{3}{4}$	$6\frac{1}{3}$	$8\frac{4}{5}$	$8\frac{3}{4}$	$6\frac{2}{4}$
	$4\frac{2}{5}$	$5\frac{2}{3}$	$3\frac{2}{5}$	$6\frac{2}{4}$	8	$6\frac{1}{5}$	$2\frac{2}{4}$	8
	$3\frac{2}{5}$	$8\frac{1}{3}$	$8\frac{2}{5}$	$8\frac{3}{4}$	9	8	3	9

Subtract:

3.	$6\frac{1}{3}$	$6\frac{1}{4}$	$4\frac{1}{5}$	$4\frac{2}{5}$	$5\frac{1}{3}$	$4\frac{3}{5}$	$7\frac{2}{4}$	$6\frac{3}{5}$
	$4\frac{2}{3}$	$2\frac{3}{4}$	$1\frac{2}{5}$	$1\frac{3}{5}$	$3\frac{2}{3}$	$1\frac{4}{5}$	$2\frac{3}{4}$	$1\frac{4}{5}$
4.	$7\frac{1}{2}$	$6\frac{3}{4}$	$8\frac{1}{5}$	$9\frac{2}{3}$	$6\frac{3}{5}$	$7\frac{1}{3}$	$8\frac{4}{5}$	$14\frac{1}{4}$
	$2\frac{1}{2}$	4	$3\frac{4}{5}$	$4\frac{1}{3}$	$2\frac{1}{5}$	$5\frac{2}{3}$	$3\frac{2}{5}$	$9\frac{3}{4}$

5. A girl's weight on June 15th was $94\frac{3}{4}$ lb., and on August 15th was $102\frac{1}{4}$ lb. How much did she gain in two months?

6. Alice bought 12 yd. of lace and used $8\frac{3}{4}$ yd. to trim a dress. How much of the lace had she left?

7. Find the sum of $2\frac{3}{5}$ lb., $6\frac{2}{5}$ lb., and $8\frac{1}{5}$ lb.

8. Find the sum of $3\frac{1}{3}$ yd., $6\frac{2}{3}$ yd., and $8\frac{2}{3}$ yd.

282. Oral Exercises.

1. In the fractions $\frac{2}{5}$, $\frac{3}{5}$, $\frac{1}{5}$, and $\frac{4}{5}$, the unit of measure is $\frac{1}{5}$. The 5 shows into how many equal parts the quantity is divided. It is called the **denominator** of the fractions. It *names* the equal parts. The 2, 3, 1, and 4 tell the *number* of equal parts taken, or the number of times the unit of measure is taken. The upper term is called the **numerator** of the fraction.

2. In $\frac{4}{6}$, 6 is the denominator. It shows that the quantity is divided into 6 equal parts, or into sixths, and that the unit of measure is $\frac{1}{6}$. The numerator is 4. It tells the number of equal parts taken, or the number of times the unit of measure, $\frac{1}{6}$, is taken.

3. A fraction whose numerator is less than the denominator is called a **proper fraction.**

4. A fraction whose numerator is equal to or greater than the denominator is called an **improper fraction.**

5. Name the numerator, the denominator, and the unit of measure in the following. Tell which are proper fractions: $\frac{5}{7}$, $\frac{6}{5}$, $\frac{3}{3}$, $\frac{5}{4}$, $\frac{7}{8}$, $\frac{2}{1}$, $\frac{6}{7}$, $\frac{9}{8}$, $\frac{4}{4}$.

6. Such numbers as 8, 7, 4, 25, etc., are called **integers.** When a number is composed of an integer and a fraction, it is called a **mixed number.** $8\frac{3}{4}$ is a mixed number. It is expressed in two units of measure. The 8 is expressed in ones, the $\frac{3}{4}$ in fourths. It may all be changed to fourths. There are $\frac{4}{4}$ in 1. In 8 there are $\frac{32}{4}$. $\frac{32}{4}$ and $\frac{3}{4}$ are $\frac{35}{4}$.

REDUCTION OF FRACTIONS

283. *To change a mixed number to an improper fraction, multiply the whole number by the denominator of the fraction, add the numerator, and write the sum over the denominator of the fraction.*

1. Change $6\frac{4}{5}$ to an improper fraction.

MODEL: $5 \times 6 = 30$
$\frac{30}{5} + \frac{4}{5} = \frac{34}{5}$

To change the 6 to fifths, multiply it by 5. 5 times 6 is 30.

2. Change the following mixed numbers to improper fractions: $8\frac{4}{5}$, $9\frac{3}{4}$, $7\frac{1}{8}$, $9\frac{2}{3}$, $10\frac{1}{2}$, $15\frac{3}{6}$, $6\frac{1}{7}$.

3. Write ten mixed numbers and change them to improper fractions.

4. Change to improper fractions: $7\frac{3}{5}$, $6\frac{2}{3}$, $3\frac{2}{7}$, $4\frac{7}{8}$.

284. *To change an improper fraction to a mixed number, divide the numerator by the denominator.*

1. Change $\frac{25}{4}$ to a mixed number.

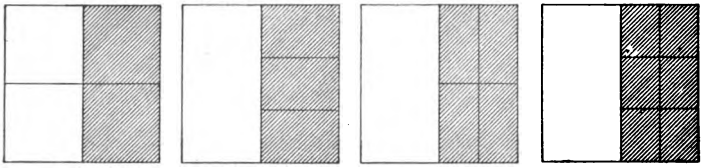
MODEL: $4)\overline{25}\quad 6\frac{1}{4}$ Divide 25 by 4.

2. Change the following improper fractions to mixed numbers: $\frac{21}{3}$, $\frac{18}{7}$, $\frac{65}{9}$, $\frac{13}{4}$, $\frac{17}{8}$, $\frac{18}{5}$.

3. Change to mixed numbers: $\frac{13}{3}$, $\frac{14}{5}$, $\frac{125}{7}$, $\frac{83}{9}$.

4. Write ten improper fractions and change them to mixed numbers.

5. Find the sum of the following by adding the numerators together. Reduce the answer to a mixed number: $\frac{5}{4}$, $\frac{16}{4}$, $\frac{23}{4}$, $\frac{14}{4}$, $\frac{17}{4}$, $\frac{7}{4}$.



$\frac{1}{2} = \frac{2}{4}$ $\frac{1}{2} = \frac{3}{6}$ $\frac{1}{2} = \frac{4}{8}$ $\frac{1}{2} = \frac{6}{12}$

285. 1. Show in a similar way: $\frac{1}{3} = \frac{x}{6}$, $\frac{1}{3} = \frac{x}{9}$, $\frac{1}{3} = \frac{x}{12}$.

2. Show in a similar way: $\frac{1}{4} = \frac{x}{8}$, $\frac{1}{4} = \frac{x}{12}$, $\frac{1}{4} = \frac{x}{16}$.

3. Change to 12ths: $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{1}{6}$.

4. Which is the larger, and how much, $\frac{1}{3}$ or $\frac{5}{12}$?

5. The fractions $\frac{1}{2}$, $\frac{3}{6}$, $\frac{4}{8}$, and $\frac{6}{12}$ are alike in *value*. They differ in *form*.

6. Can you add the following fractions as they stand: $\frac{1}{4}$ ft., $\frac{3}{4}$ ft., and $\frac{2}{4}$ ft.?

7. Can you add the following fractions as they stand: $\frac{1}{4}$ ft., $\frac{1}{3}$ ft., and $\frac{1}{2}$ ft.?

8. Can you add the fractions in Question 7 if they are changed to inches?

9. Can you add the following fractions: $\frac{1}{4}$ ft., $\frac{1}{3}$ doz., $\frac{1}{2}$ gal.? Is there a common unit to which they can be changed?

10. Multiply the numerator and the denominator of $\frac{1}{2}$ by 4. The answer is —. Has the value of the fraction been changed?

11. Multiply the numerator and the denominator of $\frac{1}{3}$ by 4. The answer is —. Has the value of the fraction been changed?

286. Oral Exercises.

1. Change $\frac{2}{3}$ to 12ths.

MODEL: 3 is contained in 12 four times. 4 times 2 is 8.

$1 = \frac{12}{12}$; $\frac{1}{3} = \frac{4}{12}$; $\frac{2}{3} = \frac{8}{12}$.

2. When $\frac{2}{3}$ is changed to 12ths, the denominator is made 4 times as large. We know this because 3 is contained in 12 four times. The numerator must also be made 4 times as large, so it is multiplied by 4.

3. Change to 12ths: $\frac{1}{2}$, $\frac{2}{3}$, $\frac{2}{4}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{3}{6}$, $\frac{1}{3}$.

4. Change to 18ths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{5}{6}$, $\frac{2}{9}$, $\frac{1}{6}$, $\frac{5}{9}$.

5. Change to 24ths: $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, $\frac{5}{12}$, $\frac{5}{8}$, $\frac{7}{12}$.

6. Change to 20ths: $\frac{4}{5}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{7}{10}$, $\frac{2}{5}$, $\frac{1}{4}$, $\frac{3}{10}$.

7. Change to 36ths: $\frac{4}{9}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{12}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{7}{9}$.

8. Change to 30ths: $\frac{1}{5}$, $\frac{5}{6}$, $\frac{3}{10}$, $\frac{2}{15}$, $\frac{1}{3}$, $\frac{3}{5}$.

287. Written Exercises.

Change to 12ths and add:

MODEL A:

1.

$\frac{1}{6} = \frac{2}{12}$
$\frac{2}{3} = \frac{8}{12}$
$\frac{1}{2} = \frac{6}{12}$
$\frac{3}{4} = \frac{9}{12}$

$\frac{25}{12} = 2\frac{1}{12}$

MODEL B:

1.

$\frac{1}{6}$ 2
$\frac{2}{3}$ 8
$\frac{1}{2}$ 6
$\frac{3}{4}$ 9

$\frac{25}{12} = 2\frac{1}{12}$

2. $\frac{3}{4}$ $\frac{1}{3}$ $\frac{1}{2}$

3. $\frac{1}{4}$ $\frac{1}{2}$ $\frac{1}{6}$

4. $\frac{5}{12}$ $\frac{3}{4}$ $\frac{2}{3}$ $\frac{1}{2}$

5. $\frac{2}{3}$ $\frac{7}{12}$ $\frac{1}{4}$ $\frac{1}{2}$

Add the fractions in Exercises 3–8, Sec. 286.

288. Written Exercises.

1. Find the sum of $8\frac{5}{6}$, $6\frac{2}{3}$, and $6\frac{3}{4}$.

Change the fractions to 12ths and add the sum of the fractions to the sum of the whole numbers.

MODEL A:	MODEL B:
$8\frac{5}{6} = 8\frac{10}{12}$	$8\frac{5}{6}$ | 10
$6\frac{2}{3} = 6\frac{8}{12}$	$6\frac{2}{3}$ | 8
$6\frac{3}{4} = 6\frac{9}{12}$	$6\frac{3}{4}$ | 9
$22\frac{3}{12} = 22\frac{1}{4}$	$22\frac{1}{4}$ | $\frac{27}{12} = 2\frac{3}{12} = 2\frac{1}{4}$

Change to 12ths and add:

2.	3.	4.	5.	6.	7.	8.
$8\frac{5}{6}$	$5\frac{2}{3}$	$7\frac{1}{4}$	$5\frac{1}{2}$	$4\frac{5}{6}$	$8\frac{7}{12}$	$1\frac{3}{4}$
$6\frac{2}{3}$	$6\frac{1}{4}$	$9\frac{3}{4}$	$8\frac{2}{3}$	$9\frac{3}{4}$	$7\frac{2}{3}$	$9\frac{1}{2}$
$7\frac{3}{4}$	$7\frac{1}{2}$	$2\frac{1}{3}$	$7\frac{5}{6}$	$8\frac{5}{12}$	$6\frac{1}{2}$	$7\frac{1}{3}$
$6\frac{1}{2}$	$8\frac{5}{6}$	$5\frac{2}{3}$	$9\frac{3}{12}$	$4\frac{2}{3}$	$4\frac{5}{6}$	$5\frac{5}{6}$
$5\frac{1}{3}$	$3\frac{3}{4}$	$6\frac{5}{6}$	$8\frac{1}{6}$	$5\frac{1}{3}$	$3\frac{3}{4}$	$6\frac{1}{4}$
$9\frac{3}{4}$	$8\frac{1}{6}$	$7\frac{1}{2}$	$7\frac{1}{3}$	$6\frac{1}{2}$	$2\frac{2}{3}$	$8\frac{11}{12}$

289. 1. The fraction $\frac{4}{8}$ may be changed to $\frac{1}{2}$ by dividing the numerator and denominator by 4. This does not change the value of the fraction.

2. *Remember:* If the numerator and the denominator of a fraction are divided by the same number, the value of the fraction is not changed.

3. The fraction $\frac{6}{8}$ is not in its *lowest terms* because both the numerator and the denominator may be divided by a number that will change them to smaller numbers without changing the value of the fraction. What is the number?

MEASURES

290. 1. The exact measures of 12 ft. are: 1 ft., 2 ft., 3 ft., 4 ft., 6 ft., and 12 ft.

2. The exact measures of 18 ft. are: 1 ft., 2 ft., 3 ft., 6 ft., 9 ft., and 18 ft.

3. 2 ft., 3 ft., and 6 ft. are each exact measures of 12 ft. and 18 ft. They are **common measures** of 12 ft. and 18 ft.

4. 6 ft. is the greatest measure that is common to 12 ft. and 18 ft. It is the **greatest common measure** of 12 ft. and 18 ft.

291. Find the exact measures of:

1. 15 gal.	4. 16 qt.	7. $26.	10. 18 in.
2. 20 gal.	5. 24 pt.	8. $30.	11. 28 da.
3. 36 ft.	6. 40 gal.	9. $48.	12. 10 ft.

Find the common measures of:

13. 12 and 18.	16. 16 and 36.	19. 24 and 36.
14. 24 and 30.	17. 10 and 40.	20. 30 and 36.
15. 36 and 48.	18. 12 and 48.	21. 14 and 28.

292. Reduce to lowest terms:

1. $\frac{6}{36}, \frac{30}{36}, \frac{4}{36}, \frac{24}{36}, \frac{32}{36}, \frac{16}{36}$.
2. $\frac{6}{24}, \frac{4}{24}, \frac{18}{24}, \frac{20}{24}, \frac{12}{24}, \frac{16}{24}$.
3. $\frac{12}{48}, \frac{32}{48}, \frac{40}{48}, \frac{36}{48}, \frac{16}{48}, \frac{44}{48}$.
4. $\frac{28}{36}, \frac{42}{60}, \frac{35}{42}, \frac{30}{48}, \frac{40}{64}, \frac{64}{72}$.
5. $\frac{8}{24}, \frac{63}{81}, \frac{54}{63}, \frac{32}{56}, \frac{14}{49}, \frac{18}{81}$.
6. $\frac{8}{48}, \frac{21}{35}, \frac{28}{49}, \frac{48}{72}, \frac{16}{64}, \frac{24}{48}$.

7. What is meant by the *greatest common measure* of two or more quantities?

This is generally known as the **greatest common divisor**, or **greatest common factor** of the quantities.

293. Oral Exercises.

Change to improper fractions:

1. $3\frac{2}{3}$ 6. $9\frac{2}{7}$ 11. $4\frac{4}{5}$ 16. $6\frac{3}{7}$ 21. $8\frac{7}{10}$
2. $5\frac{1}{7}$ 7. $8\frac{3}{8}$ 12. $9\frac{2}{9}$ 17. $5\frac{4}{5}$ 22. $7\frac{5}{12}$
3. $6\frac{3}{4}$ 8. $5\frac{1}{2}$ 13. $8\frac{1}{4}$ 18. $2\frac{2}{3}$ 23. $6\frac{7}{12}$
4. $7\frac{2}{5}$ 9. $6\frac{3}{5}$ 14. $4\frac{3}{8}$ 19. $5\frac{4}{9}$ 24. $5\frac{1}{12}$
5. $8\frac{5}{6}$ 10. $7\frac{2}{3}$ 15. $3\frac{5}{7}$ 20. $7\frac{1}{9}$ 25. $8\frac{3}{11}$

294. Oral Exercises.

Change to whole or mixed numbers:

1. $\frac{27}{3}$ ft. 6. $\frac{36}{4}$ lb. 11. $\frac{18}{3}$ ft. 16. $\frac{3}{2}$ ft. 21. $\$\frac{18}{2}$
2. $\frac{16}{5}$ in. 7. $\frac{22}{5}$ qt. 12. $\frac{24}{7}$ da. 17. $\frac{8}{3}$ yd. 22. $\$\frac{17}{4}$
3. $\frac{25}{4}$ da. 8. $\frac{17}{3}$ ft. 13. $\frac{63}{9}$ mi. 18. $\frac{12}{4}$ in. 23. $\$\frac{10}{2}$
4. $\frac{16}{3}$ yd. 9. $\frac{24}{8}$ yd. 14. $\frac{48}{6}$ pt. 19. $\frac{16}{8}$ mi. 24. $\$\frac{36}{4}$
5. $\frac{11}{2}$ da. 10. $\frac{16}{9}$ rd. 15. $\frac{17}{4}$ lb. 20. $\frac{13}{3}$ ft. 25. $\$\frac{20}{4}$

295. Oral Exercises.

1. $\frac{3}{4}$ ft. $=\frac{x}{12}$ ft. 5. $\frac{2}{3}$ da. $=\frac{x}{24}$ da. 9. $\frac{5}{6}$ ft. $=\frac{x}{36}$ ft.
2. $\frac{2}{3}$ yd. $=\frac{x}{12}$ yd. 6. $\frac{3}{4}$ da. $=\frac{x}{24}$ da. 10. $\frac{2}{9}$ ft. $=\frac{x}{36}$ ft.
3. $\frac{5}{6}$ mi. $=\frac{x}{12}$ mi. 7. $\frac{5}{6}$ da. $=\frac{x}{24}$ da. 11. $\frac{1}{12}$ ft. $=\frac{x}{36}$ ft.
4. $\frac{1}{2}$ ft. $=\frac{x}{12}$ ft. 8. $\frac{3}{8}$ da. $=\frac{x}{24}$ da. 12. $\frac{3}{4}$ ft. $=\frac{x}{36}$ ft.

296. Oral Exercises.

Reduce to lowest terms:

1. $\frac{16}{24}$ 5. $\frac{24}{60}$ 9. $\frac{10}{120}$ 13. $\frac{90}{900}$ 17. $\frac{40}{60}$ 21. $\frac{11}{99}$
2. $\frac{25}{45}$ 6. $\frac{36}{72}$ 10. $\frac{35}{95}$ 14. $\frac{42}{48}$ 18. $\frac{18}{27}$ 22. $\frac{12}{144}$
3. $\frac{60}{90}$ 7. $\frac{40}{120}$ 11. $\frac{21}{49}$ 15. $\frac{20}{24}$ 19. $\frac{54}{60}$ 23. $\frac{12}{108}$
4. $\frac{18}{80}$ 8. $\frac{50}{100}$ 12. $\frac{36}{48}$ 16. $\frac{28}{63}$ 20. $\frac{44}{55}$ 24. $\frac{8}{96}$

FACTORS AND MULTIPLES

297. Oral Exercises.

1. Numbers that are exactly divisible by 2 are **even numbers.**

2. Name the even numbers to 30. Numbers that are exactly divisible by 2 end in what figures?

3. Numbers that are not exactly divisible by 2 are **odd numbers.**

4. Name the odd numbers to 30.

5. Some numbers cannot be divided by any whole numbers except themselves and 1 without leaving a remainder. These are called **prime numbers.** The following are prime numbers: 1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97. These can be divided only by themselves and 1 without leaving a remainder.

6. A **factor** of a number is one of two or more numbers which multiplied together will make the number. 6 and 5 are each factors of 30. 2, 3, 4, and 6 are each factors of 12.

7. A **common factor** is a common unit of measure. 6 is a common factor of 12 and of 36, because both of these numbers are exactly divisible by 6. Name the common factors of 24 and 36.

To reduce a fraction to its lowest terms, divide both numerator and denominator by their common factors.

298. Oral Exercises.

1. The multiples of 2 are: 2, 4, 6, 8, 10, 12, etc.

2. The multiples of 3 are: 3, 6, 9, 12, 15, etc.

3. Which of the above numbers are multiples of both 2 and 3?

4. Numbers that are multiples of two or more numbers are called **common multiples** of the numbers. 6 and 12 are common multiples of 2 and 3.

5. The least common multiple of 2 and 3 is 6.

6. Find the least common multiple of 3 and 5.

7. Find the least common multiple of 6 and 8.

8. Find the least common multiple of 6 and 9.

9. In the fractions $\frac{2}{3}$ and $\frac{3}{4}$, the least common multiple of the denominators is 12. It is called the **least common denominator** of the fractions.

299. Written Exercises.

1. Change to least common denominators and add:

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
$\frac{2}{3}$	$\frac{4}{5}$	$\frac{5}{6}$	$\frac{4}{7}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{2}{9}$	$\frac{2}{5}$	$\frac{7}{8}$	$\frac{1}{9}$	$\frac{4}{5}$	$\frac{5}{12}$
$\frac{3}{4}$	$\frac{3}{4}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{5}{6}$	$\frac{1}{6}$	$\frac{5}{6}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{1}{8}$	$\frac{3}{4}$

2. What is the least common multiple of 2, 3, and 4?

3. What is the least common multiple of 3, 4, and 5?

4. What is the least common multiple of 6, 4, and 8?

5. Name the prime numbers below 10.

6. Find the least common multiple of 7 and 9. Since 7 is a prime number, the least common multiple of 7 and 9 is their product.

7. What is the least common multiple of 7 and 8? Of 7 and 6? Of 5 and 7? Of 5 and 9?

300. Written Exercises.

1. From $5\frac{2}{3}$ subtract $2\frac{3}{4}$.

MODEL A:

$$\begin{array}{r} 5\frac{2}{3} = 5\frac{8}{12} \\ -2\frac{3}{4} = 2\frac{9}{12} \\ \hline 2\frac{11}{12} \end{array}$$

MODEL B:

$$\begin{array}{r|l} 5\frac{2}{3} & 8 \\ -2\frac{3}{4} & 9 \\ \hline 2\ \frac{11}{12} & \end{array}$$

Add $\frac{12}{12}$ to the fraction of the minuend, making it $\frac{20}{12}$. $\frac{9}{12}$ and $\frac{11}{12}$ are $\frac{20}{12}$. Add 1 to 2. 3 and 2 are 5.

Solve:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
2.	$6\frac{3}{4}$	$5\frac{2}{3}$	$6\frac{1}{3}$	$7\frac{2}{3}$	$8\frac{1}{4}$	$6\frac{2}{5}$	$8\frac{1}{4}$	$9\frac{2}{3}$
	$-4\frac{1}{3}$	$-2\frac{3}{4}$	$-4\frac{1}{4}$	$-5\frac{1}{2}$	$-5\frac{3}{4}$	$-4\frac{3}{4}$	$-4\frac{2}{3}$	$-6\frac{4}{5}$
3.	$15\frac{1}{5}$	$19\frac{2}{5}$	$18\frac{2}{7}$	$9\frac{4}{5}$	$12\frac{1}{4}$	$7\frac{5}{12}$	$6\frac{3}{8}$	$5\frac{1}{2}$
	$-8\frac{3}{4}$	$-9\frac{3}{4}$	$-7\frac{2}{3}$	$-4\frac{1}{5}$	$-8\frac{1}{12}$	$-2\frac{3}{4}$	$-4\frac{1}{12}$	$-4\frac{5}{6}$
4.	$18\frac{3}{4}$	$16\frac{5}{9}$	28	$43\frac{2}{3}$	$26\frac{4}{5}$	30	$30\frac{2}{3}$	$30\frac{2}{5}$
	$-8\frac{1}{2}$	$-4\frac{1}{3}$	$-7\frac{3}{4}$	-7	$-4\frac{2}{5}$	$-9\frac{2}{3}$	-9	$-9\frac{2}{5}$

Add each of the above exercises.

301. Oral Exercises.

1. Change to improper fractions: $3\frac{2}{3}$, $8\frac{4}{5}$, $9\frac{5}{6}$, $7\frac{5}{8}$.

2. Change to whole or mixed numbers: $\frac{17}{6}$, $\frac{38}{4}$, $\frac{23}{7}$, $\frac{60}{9}$.

3. Reduce to lowest terms: $\frac{48}{60}$, $\frac{24}{36}$, $\frac{12}{30}$, $\frac{18}{45}$, $\frac{45}{81}$.

4. What are the common factors of 12 and 8?

5. What is the least common multiple of 12 and 8?

6. Change $\frac{2}{3}$ to 30ths; $\frac{4}{5}$ to 40ths; $\frac{5}{6}$ to 24ths.

7. $\frac{1}{2}=\frac{x}{100}$; $\frac{1}{4}=\frac{x}{100}$; $\frac{3}{4}=\frac{x}{100}$; $\frac{1}{5}=\frac{x}{100}$; $\frac{2}{5}=\frac{x}{100}$; $\frac{3}{5}=\frac{x}{100}$; $\frac{4}{5}=\frac{x}{100}$.

8. Find $\frac{2}{3}$ of \$12; $\frac{3}{4}$ of \$12; $\frac{5}{6}$ of \$12; $\frac{3}{8}$ of 24 hr.

9. 6 is $\frac{2}{3}$ of —; 8 is $\frac{4}{5}$ of —; 9 is $\frac{3}{4}$ of —; 12 is $\frac{6}{7}$ of —.

10. Name the prime numbers between 1 and 30.

302. Written Problems.

1. A girl bought $8\frac{1}{2}$ yd. of ribbon. She used $5\frac{3}{4}$ yd. How many yards had she left?

2. James weighs $84\frac{3}{4}$ lb. and George weighs 97 lb. How much heavier is George than James?

3. What is the sum of $6\frac{2}{3}$ yd. and $8\frac{3}{4}$ yd.?

4. A man owned $247\frac{2}{3}$ acres of land. He sold $122\frac{4}{5}$ acres. How many acres had he left?

5. The sides of a field are $271\frac{2}{3}$ rd., 290 rd., $175\frac{2}{3}$ rd., and $180\frac{3}{4}$ rd. Find the distance around the field.

6. Find the distance around a room that is $14\frac{3}{4}$ ft. long and $9\frac{2}{3}$ ft. wide.

303. Written Exercises.

Add:

a	*b*	*c*	*d*
$137\frac{1}{5}$	$66\frac{2}{3}$	$997\frac{1}{8}$	$54\frac{1}{5}$
$142\frac{1}{10}$	$88\frac{5}{6}$	$885\frac{3}{4}$	$68\frac{2}{10}$
$183\frac{3}{20}$	$99\frac{7}{12}$	$667\frac{1}{16}$	$88\frac{1}{20}$
$988\frac{2}{5}$	$88\frac{1}{3}$	$832\frac{5}{8}$	$99\frac{3}{10}$
$879\frac{3}{10}$	$99\frac{1}{6}$	$238\frac{7}{16}$	$65\frac{11}{20}$
$777\frac{11}{20}$	$78\frac{5}{12}$	$965\frac{1}{4}$	$76\frac{3}{5}$

304. 1. Harry weighs $72\frac{1}{2}$ lb. George weighs $2\frac{3}{4}$ lb. more than Harry. Find the weight of George.

2. Find by addition the cost of 8 yards of cloth at $12\frac{1}{2}¢$ a yard.

3. A tailor had a piece of cloth containing $24\frac{3}{4}$ yd. From this piece he used $3\frac{2}{3}$ yd. to make a pair of trousers. How much of the piece remained?

4. A grocer bought sugar at $4\frac{3}{4}¢$ a pound. He sold it at the rate of 18 lb. for \$1. How much did he receive per pound for it? Find his profit per pound.

5. At $14\frac{1}{2}¢$ a pound, what is the cost of a turkey that weighs 8 pounds?

6. At $12\frac{1}{2}¢$ a pound, what is the cost of a roast that weighs 8 pounds?

7. After selling $3\frac{1}{2}$ yd. of ribbon, there was left $9\frac{3}{4}$ yd. Find the length of the piece before the sale.

8. What number subtracted from 12 leaves 9? What number subtracted from $\frac{4}{5}$ leaves $\frac{1}{5}$?

305. Written Exercises.

1. Reduce to a common denominator: $\frac{4}{5}$, $\frac{3}{4}$, $\frac{1}{2}$, $\frac{7}{10}$. 10 is a multiple of 5; 4 is a multiple of 2. Therefore, we need to find only the common denominator of 4 and 10. This will contain all of the denominators. Why?

2. Reduce to a common denominator and add. First determine which denominators need not be considered.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*
$\frac{3}{4}$	$\frac{7}{8}$	$\frac{6}{7}$	$\frac{4}{5}$	$\frac{5}{9}$	$\frac{7}{8}$	$\frac{11}{12}$	$\frac{7}{9}$	$\frac{9}{10}$	$\frac{1}{2}$	$\frac{7}{8}$	$\frac{6}{7}$	$\frac{2}{5}$
$\frac{1}{2}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{5}{6}$	$\frac{5}{8}$	$\frac{3}{8}$	$\frac{4}{5}$	$\frac{2}{3}$	$\frac{1}{6}$	$\frac{13}{14}$	$\frac{4}{7}$
$\frac{2}{3}$	$\frac{2}{3}$	$\frac{3}{8}$	$\frac{3}{10}$	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{3}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{7}{10}$
$\frac{5}{6}$	$\frac{7}{9}$	$\frac{1}{2}$	$\frac{5}{6}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{3}{4}$	$\frac{1}{3}$	$\frac{5}{6}$	$\frac{5}{12}$	$\frac{3}{7}$	$\frac{1}{2}$

306. Add:

a	*b*	*c*	*d*	*e*	*f*	*g*
$24\frac{5}{9}$	$67\frac{1}{8}$	$34\frac{2}{3}$	$76\frac{1}{3}$	$69\frac{1}{2}$	$58\frac{2}{3}$	$79\frac{1}{6}$
$66\frac{1}{2}$	$53\frac{2}{5}$	$65\frac{1}{5}$	$84\frac{3}{4}$	$73\frac{3}{5}$	$74\frac{4}{5}$	$83\frac{1}{5}$
$73\frac{1}{3}$	$49\frac{3}{4}$	$47\frac{3}{10}$	$59\frac{5}{6}$	$87\frac{1}{10}$	$56\frac{1}{2}$	$95\frac{2}{3}$
$94\frac{5}{6}$	$78\frac{7}{10}$	$68\frac{5}{6}$	$72\frac{3}{8}$	$96\frac{5}{6}$	$87\frac{1}{3}$	$82\frac{7}{10}$

307. Subtract:

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
1.	$78\frac{2}{3}$	$96\frac{1}{2}$	$67\frac{2}{5}$	$86\frac{2}{3}$	$90\frac{5}{7}$	$65\frac{3}{8}$	$98\frac{3}{7}$	$43\frac{5}{12}$
	$25\frac{3}{4}$	$80\frac{5}{8}$	$37\frac{5}{6}$	$47\frac{4}{5}$	$37\frac{2}{6}$	$24\frac{3}{4}$	$54\frac{2}{5}$	$17\frac{3}{8}$
2.	$96\frac{3}{8}$	$74\frac{4}{5}$	$28\frac{3}{5}$	$79\frac{5}{12}$	$85\frac{1}{6}$	$47\frac{2}{3}$	$78\frac{1}{2}$	$98\frac{7}{12}$
	$47\frac{1}{5}$	$36\frac{3}{7}$	$10\frac{2}{3}$	$64\frac{3}{4}$	$26\frac{3}{5}$	$16\frac{5}{8}$	$45\frac{3}{4}$	$12\frac{2}{3}$

MULTIPLICATION OF FRACTIONS

308. Oral Exercises.

1. In the fraction $\frac{2}{5}$, which figure tells the size of the parts? What does the numerator tell?

2. How does the fractional part $\frac{2}{5}$ compare in size with the fractional part $\frac{4}{5}$?

3. What is the sum of $\frac{2}{5}$ and $\frac{2}{5}$? Of $\frac{3}{4}$ and $\frac{3}{4}$?

4. What is the sum of $\frac{2}{5}$ and $\frac{2}{5}$ and $\frac{2}{5}$? $\frac{6}{5} = — \frac{1}{5}$.

5. What is 3 times $\frac{2}{5}$? What is 3 times $\frac{3}{4}$?

To multiply a fraction by a whole number, multiply its numerator by the whole number. If the product is an improper fraction, reduce it to a whole or a mixed number.

6. Multiply: $\frac{3}{4}$ by 5, $\frac{2}{7}$ by 6, $\frac{4}{5}$ by 4, $\frac{6}{7}$ by 3.

7. Which represents the larger fractional part, $\frac{1}{4}$ or $\frac{1}{2}$? $\frac{1}{8}$ or $\frac{1}{4}$? $\frac{1}{6}$ or $\frac{1}{3}$? $\frac{1}{8}$ or $\frac{1}{2}$? $\frac{1}{6}$ or $\frac{1}{2}$?

8. How does the length of $\frac{1}{2}$ ft. compare with the length of $\frac{1}{4}$ ft.? $\frac{1}{4}$ yd. with $\frac{1}{8}$ yd.? $\frac{1}{6}$ ft. with $\frac{1}{12}$ ft.?

9. If the denominator of $\frac{1}{4}$ is divided by 2, the fraction is changed to $\frac{1}{2}$. $\frac{1}{2}$ is 2 times $\frac{1}{4}$. To multiply $\frac{1}{4}$ by 2, divide its denominator by 2.

To multiply a fraction by a whole number, divide its denominator by the whole number if the denominator is exactly divisible by the whole number. If the result is an improper fraction, change it to a whole or a mixed number.

10. Multiply by dividing the denominator: $\frac{7}{8}$ by 8; $\frac{5}{6}$ by 3; $\frac{17}{18}$ by 9; $\frac{11}{12}$ by 6; $\frac{20}{21}$ by 7.

11. Multiply $\frac{17}{18}$ by 9 by multiplying the numerator by 9.

12. Multiply $\frac{17}{18}$ by 9 by dividing the denominator by 9.

13. Which of the above methods is the easier? Why?

14. When can the easier method be used?

309. Oral Exercises.

Wherever possible, divide the denominator.

	a	*b*	*c*	*d*	*e*	*f*
1.	$\frac{8}{9}\times 5$	$\frac{5}{6}\times 3$	$\frac{2}{3}\times 3$	$\frac{5}{18}\times 6$	$\frac{13}{14}\times 7$	$\frac{6}{32}\times 4$
2.	$\frac{5}{9}\times 3$	$\frac{7}{9}\times 3$	$\frac{4}{5}\times 7$	$\frac{9}{10}\times 5$	$\frac{11}{12}\times 6$	$\frac{23}{24}\times 8$
3.	$\frac{3}{4}\times 4$	$\frac{7}{8}\times 4$	$\frac{7}{8}\times 8$	$\frac{19}{21}\times 7$	$\frac{13}{18}\times 9$	$\frac{23}{24}\times 4$

310. Oral Exercises.

1. What is the meaning of 4×2? 4×1? $4\times\frac{1}{2}$?

2. $4\times\frac{1}{2}$ is the same as $\frac{1}{2}$ of 4. $\frac{1}{2}$ of $4=$ —. $4\times\frac{1}{2}=$ —.

3. $12\times\frac{1}{2}$ is the same as $\frac{1}{2}$ of 12. $12\times\frac{1}{2}=$ —.

4. If 12 is multiplied by $\frac{2}{3}$, will the answer be greater or less than 12?

5. Multiply 12 by $\frac{5}{6}$.

MODEL: $\frac{1}{6}$ of 12 is 2; $\frac{5}{6}$ of 12 are 5 times 2, or 10.

6. Multiply: 18 by $\frac{5}{6}$; 14 by $\frac{3}{7}$; 12 by $\frac{2}{3}$; 16 by $\frac{7}{8}$; 18 by $\frac{2}{9}$; 10 by $\frac{3}{5}$; 24 by $\frac{3}{8}$; 16 by $\frac{3}{4}$; 18 by $\frac{7}{9}$; 16 by $\frac{15}{16}$; 20 by $\frac{3}{4}$; 24 by $\frac{5}{6}$; 30 by $\frac{3}{10}$; 25 by $\frac{3}{5}$; 12 by $\frac{2}{3}$.

311. Oral Exercises.

1. $\frac{1}{3}$ of 7 may be indicated thus: $\frac{7}{3}$. This is read *seven thirds*, or 7 divided by 3.

2. $\frac{1}{3}$ of $10 = \frac{10}{3}$, or $3\frac{1}{3}$. $\frac{1}{4}$ of $9 = \frac{9}{4}$, or $— \frac{1}{4}$.

3. $\frac{1}{4}$ of $5 = \frac{5}{4}$. $\frac{1}{7}$ of $9 = \frac{9}{7}$. $\frac{1}{5}$ of $4 = \frac{4}{5}$. $\frac{1}{6}$ of $5 = \frac{5}{6}$.

4. Find $\frac{2}{3}$ of 7.

MODEL: $\frac{1}{3}$ of $7 = 2\frac{1}{3}$. $\frac{2}{3}$ of 7 = 2 times $2\frac{1}{3}$, or $4\frac{2}{3}$.

5. Solve: $9 \times \frac{3}{4}$; $8 \times \frac{4}{5}$; $11 \times \frac{2}{3}$; $8 \times \frac{6}{7}$; $4 \times \frac{2}{3}$.

To multiply a whole number by a fraction, divide the whole number by the denominator of the fraction and multiply the quotient by the numerator.

312. Oral Exercises.

	a	*b*	*c*	*d*	*e*
1.	$9 \times \frac{4}{5}$	$5 \times \frac{2}{3}$	$11 \times \frac{2}{5}$	$18 \times \frac{7}{9}$	$12 \times \frac{5}{6}$
2.	$7 \times \frac{2}{3}$	$6 \times \frac{5}{7}$	$24 \times \frac{3}{4}$	$11 \times \frac{5}{9}$	$27 \times \frac{3}{9}$
3.	$8 \times \frac{3}{5}$	$16 \times \frac{3}{4}$	$12 \times \frac{2}{5}$	$12 \times \frac{3}{7}$	$21 \times \frac{5}{7}$
4.	$7 \times \frac{5}{6}$	$18 \times \frac{2}{9}$	$18 \times \frac{5}{6}$	$30 \times \frac{5}{6}$	$22 \times \frac{4}{11}$
5.	$6 \times \frac{2}{3}$	$20 \times \frac{4}{5}$	$12 \times \frac{3}{4}$	$16 \times \frac{3}{8}$	$40 \times \frac{3}{10}$

313. Oral Exercises.

	a	*b*	*c*	*d*	*e*
1.	$\frac{4}{5}$ of 30	$\frac{3}{8}$ of 7	$\frac{9}{10}$ of 60	$\frac{17}{18} \times 9$	$20 \times \frac{3}{4}$
2.	$\frac{7}{8}$ of 40	$\frac{7}{8}$ of 5	$\frac{9}{10}$ of 50	$\frac{5}{18} \times 6$	$15 \times \frac{2}{3}$
3.	$\frac{6}{7}$ of 35	$\frac{2}{3}$ of 8	$\frac{6}{4} \times 7$	$\frac{23}{24} \times 6$	$25 \times \frac{4}{5}$
4.	$\frac{7}{8}$ of 56	$\frac{8}{9}$ of 3	$4 \times \frac{2}{3}$	$21 \times \frac{6}{7}$	$12 \times \frac{5}{6}$
5.	$\frac{7}{8}$ of 24	$\frac{6}{7}$ of 49	$\frac{4}{5} \times 7$	$18 \times \frac{7}{9}$	$11 \times \frac{3}{4}$

314. Written Exercises.

1. Multiply $24\frac{3}{4}$ by 8.

MODEL:
$$\begin{array}{r} 24\frac{3}{4} \\ \underline{\quad\quad 8} \\ 6 \\ 192 \\ \hline 198 \end{array}$$

First, multiply $\frac{3}{4}$ by 8. 8 times $\frac{3}{4} = \frac{24}{4} = 6$. Next, multiply 24 by 8. Add the products.

	a	*b*	*c*	*d*
2.	$35\frac{2}{5} \times 5$	$345\frac{2}{3} \times 4$	$306\frac{5}{6} \times 75$	$725\frac{4}{5} \times 84$
3.	$67\frac{3}{8} \times 8$	$725\frac{3}{4} \times 3$	$937\frac{2}{5} \times 84$	$423\frac{2}{3} \times 60$
4.	$95\frac{4}{5} \times 5$	$467\frac{5}{6} \times 4$	$784\frac{1}{4} \times 23$	$596\frac{4}{5} \times 70$
5.	$30\frac{1}{2} \times 6$	$879\frac{6}{7} \times 8$	$986\frac{4}{5} \times 46$	$640\frac{4}{5} \times 50$

315. Written Exercises.

1. Multiply 64 by $4\frac{3}{5}$.

MODEL:
$$\begin{array}{r} 64 \\ \underline{\quad 4\frac{3}{5}} \\ 38\frac{2}{5} \\ 256 \\ \hline 294\frac{2}{5} \end{array}$$

First, multiply 64 by $\frac{3}{5}$. $\frac{1}{5}$ of $64 = 12\frac{4}{5}$. $\frac{3}{5}$ of 64 = 3 times $12\frac{4}{5}$, or $38\frac{2}{5}$. Next, multiply 64 by 4. Add the products.

Solve:

	a	*b*	*c*	*d*
2.	$675 \times 9\frac{3}{5}$	$300 \times 4\frac{3}{4}$	$464 \times 6\frac{2}{3}$	$723 \times 6\frac{3}{5}$
3.	$864 \times 4\frac{3}{4}$	$950 \times 2\frac{2}{5}$	$405 \times 9\frac{1}{5}$	$800 \times 5\frac{2}{3}$
4.	$576 \times 5\frac{2}{3}$	$375 \times 8\frac{4}{5}$	$672 \times 3\frac{7}{8}$	$967 \times 6\frac{7}{8}$
5.	$674 \times 8\frac{4}{5}$	$675 \times 3\frac{2}{7}$	$456 \times 5\frac{1}{2}$	$734 \times 4\frac{4}{5}$

316. Written Exercises.

Multiply each by 6, 8, and 9:

	a	*b*	*c*	*d*	*e*
1.	$231\frac{5}{7}$	$579\frac{3}{4}$	$768\frac{5}{9}$	$756\frac{2}{3}$	$697\frac{3}{4}$
2.	$327\frac{5}{6}$	$968\frac{5}{7}$	$648\frac{3}{8}$	$748\frac{4}{7}$	$764\frac{3}{5}$
3.	$432\frac{4}{5}$	$786\frac{6}{7}$	$975\frac{5}{12}$	$654\frac{17}{18}$	$924\frac{5}{8}$

317. Oral Exercises.

Reduce to lowest terms:

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	$\frac{15}{40}$	$\frac{14}{28}$	$\frac{36}{48}$	$\frac{12}{144}$	$\frac{96}{144}$	$\frac{25}{100}$	$\frac{16}{24}$
2.	$\frac{18}{24}$	$\frac{27}{36}$	$\frac{24}{30}$	$\frac{19}{108}$	$\frac{50}{100}$	$\frac{40}{100}$	$\frac{25}{75}$
3.	$\frac{20}{30}$	$\frac{16}{48}$	$\frac{64}{72}$	$\frac{56}{96}$	$\frac{20}{100}$	$\frac{75}{100}$	$\frac{72}{81}$

318. Oral Exercises.

Change to whole or mixed numbers:

	a	*b*	*c*	*d*	*e*	*f*	*g*
1.	$\frac{16}{5}$	$\frac{70}{8}$	$\frac{38}{8}$	$\frac{25}{3}$	$\frac{60}{8}$	$\frac{73}{9}$	$\frac{65}{7}$
2.	$\frac{27}{4}$	$\frac{90}{9}$	$\frac{47}{6}$	$\frac{100}{5}$	$\frac{75}{8}$	$\frac{68}{7}$	$\frac{60}{7}$
3.	$\frac{21}{3}$	$\frac{84}{12}$	$\frac{96}{12}$	$\frac{100}{4}$	$\frac{18}{3}$	$\frac{49}{8}$	$\frac{144}{12}$

319. Written Exercises.

Find the sum and the difference of each:

	a	*b*	*c*	*d*
1.	$97\frac{3}{4}$ lb.	$104\frac{4}{5}$ ft.	$924\frac{4}{5}$ lb.	$764\frac{3}{10}$ mi.
	$28\frac{1}{2}$ lb.	$74\frac{5}{6}$ ft.	$634\frac{1}{6}$ lb.	$684\frac{7}{10}$ mi.
2.	$76\frac{2}{3}$ mi.	$367\frac{2}{3}$ A.	$375\frac{5}{9}$ yd.	$694\frac{1}{2}$ lb.
	$24\frac{5}{8}$ mi.	$145\frac{3}{4}$ A.	$194\frac{1}{2}$ yd.	$375\frac{3}{4}$ lb.

320. Written Problems.

1. Find the cost of 6 lb. of sugar at $5\frac{3}{4}¢$ a pound.

2. At $12\frac{1}{2}¢$ a pound, how much will 6 pounds of meat cost?

3. What is the cost of $3\frac{3}{4}$ lb. of steak at $16¢$ a pound?

4. George lives $4\frac{2}{3}$ mi. from the city. How far must he ride in making 2 round trips to the city?

5. The average weight of 4 boys is $87\frac{3}{4}$ lb. Find their total weight.

6. Alice bought $5\frac{1}{2}$ yd. of lace. She used $2\frac{2}{3}$ yd. to trim a waist. How much of the lace had she left?

7. If each can of milk contains $3\frac{3}{4}$ gal., how much milk is there in 6 cans?

8. A man walked at the rate of 4 miles an hour. It took him $2\frac{3}{4}$ hr. to go from his home to the city. How far from the city did he live?

9. A man had $137\frac{1}{2}$ A. of land. He sold $43\frac{3}{4}$ A. to one man and $64\frac{1}{2}$ A. to another. How much did he sell to both? How many acres had he left?

10. How much will $2\frac{3}{4}$ lb. of tea cost at $60¢$ per pound?

11. Find the cost of 8 yd. of cloth at $12\frac{1}{2}¢$ per yard.

12. How many rods of fence will it take to fence in a garden $14\frac{1}{2}$ rd. long and $8\frac{3}{4}$ rd. wide?

13. Find the cost of $8\frac{3}{4}$ T. of coal at $\$6$ per ton.

DIVISION OF FRACTIONS

321. Oral Exercises.

1. How does the fractional part $\frac{4}{5}$ compare in size with the fractional part $\frac{2}{5}$?

2. How can the fractional part $\frac{2}{5}$ be obtained from the fractional part $\frac{4}{5}$?

3. How can the fractional part $\frac{4}{9}$ be obtained from the fractional part $\frac{8}{9}$?

4. If the fractional part $\frac{6}{7}$ is divided by 2, the quotient will be $\frac{x}{7}$.

To divide a fraction by a whole number, divide its numerator by the whole number.

5. Divide $\frac{8}{9}$ by 2; $\frac{16}{17}$ by 2; $\frac{14}{15}$ by 2; $\frac{18}{19}$ by 3; $\frac{6}{7}$ by 3.

6. Divide $\frac{14}{15}$ by 7; $\frac{8}{9}$ by 4; $\frac{6}{7}$ by 2; $\frac{20}{25}$ by 5; $\frac{24}{25}$ by 6; $\frac{12}{13}$ by 4.

7. Divide $\frac{4}{5}$ by 4; $\frac{20}{25}$ by 10; $\frac{16}{17}$ by 8; $\frac{9}{10}$ by 3; $\frac{12}{13}$ by 3; $\frac{10}{11}$ by 5.

8. How does the fractional part $\frac{1}{2}$ compare with the fractional part $\frac{1}{4}$?

9. What part of $\frac{1}{4}$ is $\frac{1}{8}$? What part of $\frac{1}{5}$ is $\frac{1}{10}$?

10. How does the fractional part $\frac{1}{3}$ compare with the fractional part $\frac{1}{6}$? How can the fractional part $\frac{1}{6}$ be obtained from the fractional part $\frac{1}{3}$?

11. If the fractional part $\frac{1}{3}$ is divided by 2, the quotient will be —. Multiplying the denominator of a fraction by 2 has what effect upon the value of the fraction?

322. *To divide a fraction by a whole number, multiply the denominator of the fraction by the whole number.*

1. Divide: $\frac{2}{3}$ by 4; $\frac{3}{4}$ by 5; $\frac{5}{6}$ by 7; $\frac{3}{5}$ by 2; $\frac{6}{7}$ by 5.

2. Divide: $\frac{7}{8}$ by 2; $\frac{5}{7}$ by 3; $\frac{4}{5}$ by 3; $\frac{3}{8}$ by 4; $\frac{1}{2}$ by 6; $\frac{1}{3}$ by 5.

3. Divide: $\frac{3}{8}$ by 5; $\frac{11}{12}$ by 2; $\frac{2}{7}$ by 4; $\frac{5}{9}$ by 3; $\frac{1}{6}$ by 3.

4. Divide the fraction $\frac{18}{19}$ by 6 by dividing its numerator by 6. To divide by 6 is to find $\frac{1}{6}$. Find $\frac{1}{6}$ of $\frac{24}{25}$.

5. Divide the fraction $\frac{18}{19}$ by 6 by multiplying its denominator by 6. Reduce to lowest terms.

6. Which is the easier method of dividing $\frac{18}{19}$ by 6? Why?

7. When is it easier to find the quotient by dividing the numerator by the whole number?

8. When is it easier to find the quotient by multiplying the denominator by the whole number?

323. Oral Exercises.

Use the easier method in solving each:

	a	*b*	*c*	*d*	
1.	$\frac{6}{7} \div 3$	$\frac{8}{9} \div 4$	$\frac{10}{11} \div 5$	$\frac{14}{15} \div 6$	$\frac{12}{13} \div 12$
2.	$\frac{4}{5} \div 3$	$\frac{2}{5} \div 10$	$\frac{10}{11} \div 6$	$\frac{12}{13} \div 7$	$\frac{25}{50} \div 25$
3.	$\frac{5}{6} \div 5$	$\frac{3}{5} \div 10$	$\frac{16}{17} \div 2$	$\frac{8}{11} \div 3$	$\frac{20}{100} \div 10$
4.	$\frac{7}{9} \div 3$	$\frac{49}{50} \div 7$	$\frac{25}{75} \div 5$	$\frac{8}{11} \div 4$	$\frac{40}{100} \div 20$

324. Oral Exercises.

Use the easier method in solving each:

	a	*b*	*c*	*d*	*e*
1.	$\frac{2}{3} \div 5$	$\frac{6}{7} \div 4$	$\frac{10}{13} \div 5$	$30 \times \frac{3}{10}$	$\frac{7}{8}$ of 72
2.	$\frac{5}{6} \times 3$	$9 \times \frac{2}{3}$	$\frac{16}{17} \div 8$	$\frac{6}{9}$ of 7	$\frac{8}{9}$ of 27
3.	$\frac{7}{8} \times 4$	$8 \times \frac{3}{4}$	$\frac{15}{16} \div 5$	$\frac{4}{5}$ of 2	$\frac{3}{5}$ of 25
4.	$\frac{3}{8} \times 4$	$\frac{4}{15} \times 3$	$\frac{16}{17} \div 5$	$\frac{6}{7}$ of 9	$\frac{4}{5}$ of 10
5.	$\frac{7}{8} \div 6$	$\frac{14}{15} \times 5$	$17 \times \frac{1}{3}$	$\frac{7}{8}$ of 5	$\frac{2}{25}$ of 8
6.	$\frac{2}{3} \div 6$	$\frac{10}{11} \div 5$	$10 \times \frac{2}{5}$	$\frac{7}{8}$ of 48	$\frac{2}{25}$ of 50
7.	$\frac{3}{8} \div 6$	$\frac{24}{25} \div 8$	$27 \times \frac{2}{9}$	$\frac{3}{4}$ of 12	$\frac{11}{12}$ of 24

325. Written Exercises.

1. Find $\frac{1}{6}$ of $212\frac{3}{4}$.

MODEL: $6\overline{)212\frac{3}{4}}$ $\quad 35\frac{11}{24}$ 6 is contained in 21 three times, with 3 remainder. 6 is contained in 32 five times, with 2 remainder. The whole remainder is $2\frac{3}{4}$. Reduce it to $\frac{11}{4}$. $\frac{11}{4} \div 6 = \frac{11}{24}$. This is the fractional part of the quotient.

2. Divide each by 6; by 7; by 4:

$632\frac{3}{4}$, $345\frac{1}{4}$, $426\frac{3}{5}$, $785\frac{1}{2}$, $967\frac{2}{3}$, $872\frac{2}{7}$.

326. Oral Exercises.

Divide each by 4; by 5; by 6; by 7; by 8; by 9:

	a	*b*	*c*	*d*	*e*
1.	$4\frac{2}{3}$	$6\frac{2}{3}$	$9\frac{2}{7}$	$7\frac{3}{8}$	$10\frac{2}{5}$
2.	$6\frac{1}{2}$	$8\frac{7}{8}$	$8\frac{3}{5}$	$9\frac{2}{3}$	$12\frac{3}{4}$
3.	$8\frac{5}{9}$	$4\frac{4}{5}$	$5\frac{1}{4}$	$8\frac{3}{7}$	$11\frac{4}{7}$
4.	$7\frac{3}{4}$	$2\frac{3}{7}$	$7\frac{2}{3}$	$7\frac{1}{8}$	$12\frac{1}{8}$

327. Written Problems.

1. Find the cost of $2\frac{2}{3}$ lb. of coffee at 30¢ per pound.

2. A boy had 45¢. He spent $\frac{2}{3}$ of his money for a book. Find the cost of the book.

3. A horse was bought for \$120 and sold for $1\frac{2}{3}$ times its cost. Find the selling price of the horse.

4. There are 60 minutes in one hour. How many minutes are there in $\frac{5}{12}$ of an hour?

5. Find the area of a blackboard $10\frac{2}{3}$ ft. long and 3 ft. wide.

6. A blackboard containing $38\frac{1}{4}$ sq. ft. is 3 ft. wide. Find its length.

7. Six girls bought a box of candy weighing $1\frac{1}{2}$ lb. They shared it equally. How much candy did each girl receive?

8. Mary is in school $5\frac{1}{2}$ hr. each day. How many hours is she in school each week?

9. A woman bought 12 yd. of silk at \$$1\frac{3}{4}$ per yard. She handed the dealer \$25. How much change should she receive?

10. A girl had $6\frac{1}{2}$ yd. of ribbon. After using $\frac{3}{4}$ yd. for a bow, how much had she left?

11. At $12\frac{1}{2}$¢ a dozen, how much will 8 dozen eggs cost?

12. Find the area of a field $53\frac{1}{3}$ rd. long and 30 rd. wide. There are 160 sq. rd. in 1 A. Find the number of acres there are in the field.

328. 1. Draw an oblong. Divide it into 4 equal parts. What is each part called?

2. Show $\frac{3}{4}$ of the oblong. Show $\frac{1}{3}$ of $\frac{3}{4}$ of the oblong. $\frac{1}{3}$ of $\frac{3}{4}$ of the oblong is what part of the oblong?

3. Show $\frac{2}{3}$ of $\frac{3}{4}$ of the oblong. $\frac{2}{3}$ of $\frac{3}{4}$ of the oblong is what part of the oblong?

4. $\frac{1}{3}$ of $\frac{3}{4}$ is the same as $\frac{3}{4} \times \frac{1}{3}$, which is read $\frac{3}{4}$ multiplied by $\frac{1}{3}$. It is equal to —.

5. $\frac{2}{3}$ of $\frac{3}{4}$ is the same as $\frac{3}{4} \times \frac{2}{3}$. It is equal to —.

To multiply a fraction by a fraction, multiply the numerators together. This product is the numerator of the answer. Multiply the denominators together. This product is the denominator of the answer. The answer should be expressed in its lowest terms.

6. Multiply $\frac{2}{3}$ by $\frac{4}{5}$.

MODEL: $\frac{2}{3} \times \frac{4}{5}$. $\frac{2 \times 4}{3 \times 5} = \frac{8}{15}$.

7. Multiply $\frac{4}{5}$ by $\frac{3}{7}$; $\frac{5}{6}$ by $\frac{7}{8}$; $\frac{2}{3}$ by $\frac{5}{7}$; $\frac{6}{7}$ by $\frac{4}{5}$.

8. Multiply $\frac{2}{3}$ by $\frac{3}{5}$. If we multiply as above, the answer is $\frac{6}{15}$. To reduce $\frac{6}{15}$ to its lowest terms, both the numerator and the denominator must be divided by 3. The answer is $\frac{2}{5}$. Since there is a 3 in one of the numerators, and a 3 in one of the denominators, the reduction can take place before the multiplication, thus: $\frac{2}{\cancel{3}_{1}} \times \frac{\cancel{3}^{1}}{5} = \frac{2}{5}$. This is called **cancellation.**

329. Oral Exercises.

1. Multiply $\frac{4}{5}$ by $\frac{5}{7}$.

MODEL: $\frac{4}{\cancel{5}_{1}} \times \frac{\overset{1}{\cancel{5}}}{7} = \frac{4}{7}$. Cancel the common factors. Divide the 5 in $\frac{4}{5}$ by 5, and the 5 in $\frac{5}{7}$ by 5. Multiply.

	a	*b*	*c*	*d*	
2.	$\frac{4}{5} \times \frac{5}{6}$	$\frac{10}{11} \times \frac{4}{5}$	$\frac{3}{5} \times \frac{6}{12}$	$\frac{3}{12} \times \frac{4}{9}$	$\frac{8}{9} \times \frac{7}{8}$
3.	$\frac{1}{2} \times \frac{4}{5}$	$\frac{16}{17} \times \frac{3}{8}$	$\frac{5}{8} \times \frac{4}{13}$	$\frac{14}{15} \times \frac{5}{7}$	$\frac{5}{6} \times \frac{2}{3}$
4.	$\frac{8}{9} \times \frac{2}{3}$	$\frac{14}{15} \times \frac{3}{7}$	$\frac{6}{7} \times \frac{7}{12}$	$\frac{4}{11} \times \frac{2}{3}$	$\frac{1}{4} \times \frac{2}{3}$
5.	$\frac{7}{8} \times \frac{4}{5}$	$\frac{20}{21} \times \frac{7}{8}$	$\frac{9}{13} \times \frac{7}{9}$	$\frac{6}{13} \times \frac{26}{30}$	$\frac{3}{4} \times \frac{1}{8}$
6.	$\frac{3}{4} \times \frac{4}{6}$	$\frac{12}{13} \times \frac{5}{6}$	$\frac{9}{10} \times \frac{5}{9}$	$\frac{9}{10} \times \frac{4}{5}$	$\frac{1}{6} \times \frac{6}{7}$

330. Written Exercises.

1. Multiply $6\frac{2}{3}$ by $4\frac{3}{4}$.

MODEL:

$6\frac{2}{3}$

$4\frac{3}{4}$

5

$2\frac{2}{3}$

24

$31\frac{2}{3}$

$\frac{1}{4}$ of $6\frac{2}{3} = 1\frac{2}{3}$. $\frac{3}{4}$ of $6\frac{2}{3}$ is 3 times $1\frac{2}{3}$, or 5. 4 times $\frac{2}{3}$ is $\frac{8}{3}$, or $2\frac{2}{3}$. 4 times 6 is 24. Add these products.

Solve:

	a	*b*	*c*	*d*
2.	$3\frac{4}{5} \times 6\frac{1}{2}$	$9\frac{3}{8} \times 8\frac{3}{4}$	$6\frac{3}{4} \times 5\frac{4}{5}$	$11\frac{4}{5} \times 3\frac{7}{11}$
3.	$4\frac{5}{9} \times 4\frac{3}{4}$	$4\frac{2}{3} \times 6\frac{3}{7}$	$9\frac{4}{7} \times 3\frac{1}{7}$	$21\frac{14}{15} \times 4\frac{3}{5}$
4.	$5\frac{2}{3} \times 6\frac{2}{7}$	$5\frac{2}{7} \times 8\frac{4}{5}$	$4\frac{3}{5} \times 3\frac{4}{5}$	$19\frac{2}{3} \times 4\frac{2}{5}$
5.	$6\frac{1}{8} \times 4\frac{1}{4}$	$9\frac{3}{7} \times 7\frac{3}{9}$	$5\frac{1}{2} \times 7\frac{1}{2}$	$10\frac{2}{3} \times 4\frac{3}{4}$

MEASUREMENTS

331. 1. Draw a line 4 ft. long. Measure it with a measure 2 ft. long. How many times did you apply the measure? 4 ft. $\div$ 2 ft. = —.

2. Measure a line 4 ft. long with a measure 1 ft. long. How many times did you apply the measure? 4 ft. $\div$ 1 ft. = —.

3. Measure a line 4 ft. long with a measure $\frac{1}{2}$ ft. long. How many times did you apply the measure? 4 ft. $\div \frac{1}{2}$ ft. = —.

4. Measure a line 8 ft. long with a measure 2 ft. long. How many times did you apply the measure? 8 ft. $\div$ 2 ft. = —.

5. Measure a line 8 ft. long with a measure $\frac{1}{2}$ ft. long. How many times did you apply the measure? 8 ft. $\div \frac{1}{2}$ ft. = —.

6. Divide 8 ft. by 2 ft.; by 1 ft.; by $\frac{1}{2}$ ft.

7. Measure 6 ft. with a 3-ft. measure; with a 1-ft. measure; with a $\frac{1}{3}$-ft. measure; with a $\frac{2}{3}$-ft. measure. How many times did you apply each?

8. How does the number of times that you applied the 1-ft. measure compare with the number of times that you applied the $\frac{1}{3}$-ft. measure?

9. If the 1-ft. measure is applied 6 times in measuring the length of a line, how many times must the $\frac{1}{3}$-ft. measure be applied to measure the same distance?

10. How many times must the measure $\frac{1}{4}$ ft. be applied to measure 6 ft.? 6 ft. $\div \frac{1}{4}$ ft. = 24.

332. Oral Exercises.

1. In 8 ft. there are 16 half feet. $8 \text{ ft.} \div \frac{1}{2} \text{ ft.} = 16.$

2. In 6 ft. there are 18 third feet. $6 \text{ ft.} \div \frac{1}{3} \text{ ft.} = 18.$

3. In 6 ft. there are 18 third feet or 9 two-thirds feet.

4. How many fourths are there in 1? In 8?

5. How many thirds are there in 1? In 6? In 9?

6. $12 \text{ ft.} \div 1 \text{ ft.} =$ —; $12 \text{ ft.} \div \frac{1}{4} \text{ ft.} =$ —; $12 \text{ ft.} \div \frac{3}{4} \text{ ft.} =$ —.

333. *To divide a whole number by a fraction, invert the divisor and multiply.*

1. Divide 12 by $\frac{3}{4}$.

MODEL: Invert $\frac{3}{4}$ to $\frac{4}{3}$. $\overset{4}{\cancel{12}} \times \frac{4}{\cancel{3}} = 16.$

	a	*b*	*c*	*d*	*e*
2.	$12 \div \frac{3}{4}$	$7 \div \frac{4}{5}$	$36 \div \frac{6}{7}$	$12 \text{ mi.} \div \frac{6}{7} \text{ mi.}$	$20 \div \frac{4}{5}$
3.	$15 \div \frac{5}{7}$	$8 \div \frac{2}{3}$	$10 \div \frac{2}{3}$	$8 \text{ ft.} \div \frac{2}{7} \text{ ft.}$	$15 \div \frac{5}{6}$
4.	$18 \div \frac{2}{9}$	$6 \div \frac{4}{5}$	$30 \div \frac{5}{6}$	$10 \text{ lb.} \div \frac{4}{5} \text{ lb.}$	$8 \div \frac{1}{9}$
5.	$16 \div \frac{2}{3}$	$9 \div \frac{5}{6}$	$8 \div \frac{2}{5}$	$16 \text{ hr.} \div \frac{8}{9} \text{ hr.}$	$7 \div \frac{2}{3}$

334. 1. How many boxes of candy each weighing $\frac{3}{4}$ lb. can be filled from a pail containing 16 pounds?

2. A girl bought 3 yd. of ribbon at 12¢ a yard. How many hair ribbons each $\frac{2}{3}$ yd. long can be made from it? Find the cost of each ribbon.

3. How many rolls of butter each weighing $\frac{1}{2}$ lb. can be made from 14 pounds?

4. There are $5\frac{1}{2}$ yd. in a rod. How many yards are there in 6 rods?

335. 1. Measure 1 ft. with $\frac{1}{4}$-ft. measure. How many times did you apply the measure? $1 \text{ ft.} \div \frac{1}{4} \text{ ft.} = 4$.

2. Measure $\frac{3}{4}$ ft. with $\frac{1}{4}$-ft. measure. How many times did you apply the measure? $\frac{3}{4} \text{ ft.} \div \frac{1}{4} \text{ ft.} = 3$.

3. Measure $\frac{1}{2}$ ft. with $\frac{1}{4}$-ft. measure. How many times did you apply the measure? $\frac{1}{2} \text{ ft.} \div \frac{1}{4} \text{ ft.} = 2$.

4. Measure $\frac{1}{8}$ ft. with $\frac{1}{4}$-ft. measure. The measure is applied $\frac{1}{2}$ times. $\frac{1}{8} \text{ ft.} \div \frac{1}{4} \text{ ft.} = \frac{1}{2}$.

5. If a measure $\frac{1}{2}$ ft. long is used to measure $\frac{1}{4}$ ft., the measure would be applied $\frac{1}{2}$ times. $\frac{1}{4} \text{ ft.} \div \frac{1}{2} \text{ ft.} = \frac{1}{2}$.

6. If a measure $\frac{1}{2}$ ft. long is used to measure $\frac{1}{3}$ ft., would the measure be applied more or less than 1 time? With your measure find what part of $\frac{1}{2}$ ft. is used to measure $\frac{1}{3}$ ft. $\frac{1}{3} \text{ ft.} \div \frac{1}{2} \text{ ft.} = —$.

7. Measure $\frac{3}{4}$ ft. by $\frac{2}{3}$ ft. by changing both to 12ths: $\frac{3}{4} \text{ ft.} = \frac{9}{12} \text{ ft.}$; $\frac{2}{3} \text{ ft.} = \frac{8}{12} \text{ ft.}$ Measure $\frac{9}{12}$ ft. by $\frac{8}{12}$ ft.

8. Divide $\frac{3}{4}$ by $\frac{2}{3}$. This may be done by changing the fractions to a common denominator and dividing the numerators, thus: $\frac{3}{4} \div \frac{2}{3} = \frac{9}{12} \div \frac{8}{12} = 9 \div 8 = 1\frac{1}{8}$.

336. The following is a shorter method:

To divide a fraction by a fraction, invert the divisor and multiply.

1. Divide $\frac{3}{4}$ by $\frac{2}{3}$.

MODEL: $\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8}$, or $1\frac{1}{8}$.

	a	*b*	*c*	*d*	*e*
2.	$\frac{3}{4} \div \frac{5}{6}$	$\frac{8}{11} \div \frac{4}{5}$	$\frac{14}{15} \div \frac{7}{8}$	$\frac{30}{31} \div \frac{6}{7}$	$\frac{18}{19} \div \frac{3}{4}$
3.	$\frac{6}{7} \div \frac{3}{5}$	$\frac{10}{11} \div \frac{6}{7}$	$\frac{16}{17} \div \frac{8}{9}$	$\frac{13}{14} \div \frac{1}{2}$	$\frac{10}{11} \div \frac{5}{6}$

337. Written Exercises.

1. Divide $6\frac{2}{3}$ by $\frac{4}{5}$.

MODEL: $6\frac{2}{3}=\frac{20}{3}$. $\frac{20}{3}\div\frac{4}{5}=\frac{\overset{5}{\cancel{20}}}{3}\times\frac{5}{\cancel{4}}=\frac{25}{3}$, or $8\frac{1}{3}$.

Solve:

	a	*b*	*c*	*d*	*e*
2.	$6\frac{2}{3}\div\frac{4}{7}$	$12\frac{1}{2}\div\frac{3}{4}$	$7\frac{4}{5}\div\frac{3}{5}$	$10\frac{3}{5}\div\frac{2}{3}$	$9\frac{5}{6}\div\frac{3}{8}$
3.	$8\frac{2}{3}\div\frac{4}{9}$	$18\frac{2}{3}\div\frac{1}{3}$	$8\frac{1}{6}\div\frac{2}{3}$	$45\frac{4}{5}\div\frac{5}{7}$	$11\frac{1}{2}\div\frac{1}{2}$
4.	$9\frac{4}{5}\div\frac{5}{6}$	$25\frac{4}{5}\div\frac{3}{5}$	$9\frac{2}{7}\div\frac{5}{8}$	$7\frac{3}{8}\div\frac{7}{8}$	$8\frac{11}{12}\div\frac{5}{8}$
5.	$7\frac{3}{8}\div\frac{4}{5}$	$12\frac{3}{5}\div\frac{3}{4}$	$9\frac{8}{9}\div\frac{3}{10}$	$8\frac{1}{8}\div\frac{5}{6}$	$4\frac{1}{6}\div\frac{1}{3}$

338. Written Exercises.

1. Divide $4\frac{2}{3}$ by $3\frac{5}{6}$.

MODEL:

$4\frac{2}{3}=\frac{14}{3}$; $3\frac{5}{6}=\frac{23}{6}$. $\frac{14}{3}\div\frac{23}{6}=\frac{14}{\cancel{3}}\times\frac{\overset{2}{\cancel{6}}}{23}=\frac{28}{23}$, or $1\frac{5}{23}$.

Divide:

	a	*b*	*c*	*d*
2.	$2\frac{3}{4}$ by $4\frac{3}{5}$	$8\frac{1}{2}$ by $2\frac{2}{3}$	$5\frac{1}{5}$ by $4\frac{2}{3}$	$4\frac{4}{5}$ by $3\frac{3}{4}$
3.	$6\frac{7}{8}$ by $2\frac{1}{3}$	$9\frac{3}{4}$ by $3\frac{1}{4}$	$9\frac{1}{3}$ by $8\frac{1}{2}$	$2\frac{5}{9}$ by $3\frac{2}{3}$
4.	$9\frac{4}{5}$ by $6\frac{2}{3}$	$5\frac{7}{8}$ by $7\frac{2}{3}$	$8\frac{1}{4}$ by $6\frac{2}{7}$	$9\frac{1}{4}$ by $4\frac{1}{6}$
5.	$5\frac{3}{8}$ by $8\frac{3}{5}$	$4\frac{5}{6}$ by $3\frac{5}{7}$	$5\frac{5}{9}$ by $3\frac{4}{5}$	$6\frac{4}{5}$ by $4\frac{1}{6}$

339. Written Exercises.

	a	*b*	*c*	*d*
1.	$16\frac{2}{3}-12\frac{5}{8}$	$53\frac{4}{5}+34\frac{3}{4}$	$3\frac{3}{4}\times 4\frac{2}{3}$	$65\frac{1}{2}\div\frac{7}{8}$
2.	$40\frac{4}{5}+17\frac{3}{4}$	$87\frac{3}{4}-70\frac{2}{3}$	$9\frac{3}{8}\times 16$	$24\frac{1}{2}\times 5\frac{5}{6}$
3.	$56\frac{2}{3}-25\frac{1}{9}$	$24\frac{3}{5}+14\frac{2}{3}$	$65\frac{3}{8}\div 4$	$40\frac{1}{3}-34\frac{3}{4}$
4.	$65\frac{5}{8}+37\frac{3}{7}$	$44\frac{2}{3}-14\frac{4}{5}$	$3\frac{4}{7}\div 4\frac{7}{9}$	$5\frac{2}{5}\div 6\frac{3}{8}$
5.	$18\frac{2}{3}\times 6\frac{3}{4}$	$45\frac{1}{2}+54\frac{2}{3}$	$6\frac{4}{5}\div 17$	$19\frac{2}{3}-9\frac{4}{5}$
6.	$37\frac{3}{4}\div 4\frac{1}{2}$	$69\frac{4}{5}-43\frac{3}{4}$	$56\frac{2}{3}\div 8$	$4\frac{7}{8}\times 4\frac{8}{7}$

340. Written Exercises.

1. Find the surface of a walk 12 ft. 8 in. ($12\frac{2}{3}$ ft.) long and 6 ft. 9 in. ($6\frac{3}{4}$ ft.) wide.

2. Find the cost of laying cement on the same walk at $\$.12\frac{1}{2}$ per square foot.

3. One field contains $36\frac{2}{3}$ A.; another $22\frac{2}{5}$ A. Find the number of acres in the two fields.

4. If a train travels $560\frac{2}{3}$ mi. in 12 hr., what is the average rate per hour?

5. If it cost \$ 36,000 to build $3\frac{1}{2}$ mi. of trolly line, how much on the average did it cost to build 1 mi.?

6. What will be the cost of 16 doz. 8 eggs ($16\frac{2}{3}$ doz.) at 16¢ a dozen?

7. A man rented his farm for $\frac{1}{3}$ of the crop. He received for his share of oats 360 sacks. How many sacks of oats were raised on the farm?

341. Oral Exercises.

1. What part of 1 doz. eggs are 8 eggs?

2. Express in dozens and fraction of a dozen: 3 doz. 5; 4 doz. 8; 6 doz. 7.

3. Express in feet and fraction of feet: 3 ft. 6 in.; 4 ft. 8 in.; 9 ft. 7 in.

4. Find the cost of 5 doz. 6 eggs at $16\frac{1}{2}$¢ per dozen.

5. When coal is selling at \$ 8 per ton, what part of a ton can be bought for \$ 2? For \$ 4? For \$ 6?

6. How many pieces of string each $\frac{3}{4}$ ft. long can be cut from a string 6 ft. long?

342. Written Exercises.

1. A farmer raised $9\frac{1}{2}$ tons of hay on 4 acres. What was the yield per acre?

2. A man bought a house and a 50-ft. lot for \$ 4500. If the house was valued at \$ 3500, what was the value of the land per front foot?

3. When cloth is selling at $\frac{3}{5}$ dollar per yard, how many yards can be purchased for \$ 3?

4. A merchant bought cloth at \$ $.62\frac{1}{2}$ a yard. He sold it at \$ .75 a yard. How much did he gain on each yard?

5. A merchant bought cloth at \$ $.37\frac{1}{2}$ a yard, and sold it at \$ .25 a yard. How much did he lose on each yard?

6. When hay is selling at \$ 8 a ton, how many tons can be purchased for \$ 12? \$ 6? \$ 9? \$ 15?

7. Divide $7\frac{3}{5}$ in. by 2; $8\frac{3}{7}$ ft. by 3; $6\frac{3}{4}$ A. by 2; $\frac{9}{16}$ in. by $\frac{3}{4}$.

8. A woodchopper cut 12 cords of wood for \$ 18. How much was that a cord?

9. A boy has 25¢ in nickels, 30¢ in dimes, \$ 3 in quarter-dollars, and \$ 5 in half-dollars. How many pieces of money has he?

10. One square inch is what part of a square foot?

11. One square foot is what part of a square yard?

12. Divide $\frac{6}{7}$ by 2; $\frac{3}{5}$ by 4; $\frac{5}{8}$ by $\frac{2}{3}$; $\frac{6}{7}$ by 5; $12\frac{2}{3}$ by 6; $2\frac{3}{4}$ by 5; $6\frac{7}{8}$ by 4.

RATIO AND PROPORTION

343. 1. 12 apples are worth — times as much as 6 apples.

2. 4 apples are — third of 12 apples.

3. 12 apples are worth — times as much as 4 apples.

4. If 4 apples are worth 5¢, 12 apples are worth —¢.

5. If 8 apples are worth 10¢, 24 apples are worth —¢.

6. If 7 bu. of corn are worth $4.20, 21 bu. are worth $—.

7. If 4 lb. of coffee are worth $1, 6 lb. of coffee are worth $—.

8. If $2\frac{1}{2}$ yd. of cloth cost $2, 5 yd. of it will cost $—.

9. $12\frac{1}{2}$ is — half of 25; — eighth of 100; — fourth of 50; — sixth of 75; — third of $37\frac{1}{2}$; — fifth of $62\frac{1}{2}$.

10. If 25 yards of cloth cost $2.12, at the same rate how much will 50 yd. of the cloth cost?

11. $33\frac{1}{3}$ is — — of 100. 75 is — — of 100.
$66\frac{2}{3}$ is — — of 100. $37\frac{1}{2}$ is — — of 100.

12. $66\frac{2}{3}$ bu. of wheat are worth — thirds as much as 100 bu.

13. $37\frac{1}{2}$ bu. of wheat are worth — eighths as much as 100 bu.

14. 10 brooms are worth — times as much as 4 brooms of the same kind.

15. $\frac{1}{2}$ of 6 is $\frac{1}{3}$ of —. $\frac{1}{4}$ of 8 is $\frac{1}{5}$ of —.

16. $\frac{2}{3}$ of 9 apples are $\frac{3}{5}$ of — apples.

17. $\frac{4}{7}$ of 28 ft. are — ft. 8 ft. are $\frac{2}{3}$ of — ft.

18. If 5 tons of hay will feed 6 horses a certain time, 15 tons will feed — horses for the same time.

19. Twelve sacks of barley will feed 6 horses as long as — sacks will feed 24 horses.

20. Working for the same wages, 5 men can earn as much in 12 weeks as 10 men can earn in — weeks.

21. The ratio of 5 men to 10 men is the same as the ratio of 12 bu. to — bu.

22. The ratio of $\frac{1}{2}$ to $\frac{3}{2}$ is the same as the ratio of $\frac{2}{3}$ to —.

Find the cost:

23. Of 16 apples if 8 apples cost 12¢.

24. Of 32 sacks of barley if 8 sacks cost $ 7.

25. Of 25 tons of hay if 100 tons cost $ 824.

26. Of $33\frac{1}{3}$ yd. of cloth if $66\frac{2}{3}$ yd. cost $ 36.

27. Of $12\frac{1}{2}$ boxes of apples if $37\frac{1}{2}$ boxes cost $ 27.

28. Of 10 tons of grapes if 4 tons cost $ 48.

29. Of 8 sheep if 24 sheep cost $ 45.

30. Of 11 yd. of cloth if 44 yd. cost $ 22.

31. Of 1 sq. yd. of blackboard if 1 sq. ft. cost 20¢.

32. Of $1\frac{1}{2}$ doz. chickens if 3 doz. cost $ 12.

AREAS

344. 1. A rectangle 5 ft. long and $2\frac{1}{2}$ in. wide contains — sq. ft.

2. A schoolroom is 30 ft. long and 26 ft. wide. The floor contains — sq. ft.

3. How many corners are there on a cube? On a box? How many faces are there on a cube? On a box?

4. Find the area of one face of a 3-in. cube.

5. Measure the length, width, and height of any box. Using these dimensions, find the following: the area of one of the ends; the area of the two ends; the area of one of the sides; the area of the two sides; the area of the bottom of the box; the area of the top and bottom; the area of the six faces.

6. Is the room you are in shaped like a box?

7. How many faces has the room? The floor of the room corresponds to the — of the box; the ceiling of the room to the — of the box; the sides of the room to the — of the box; and the end of the room to the — of the box.

8. The man who plastered your schoolroom was paid a price per square yard for doing the work. If he received 21¢ per square yard., how much did he receive for plastering the room?

9. Think of a room that is 15 ft. long, 12 ft. wide, and 10 ft. high. Find:

a. The area of the floor; *b*. the area of the sides.

DECIMAL FRACTIONS

345. 1. Divide 27 by 4. Divide 32 by 5. Read the answers.

2. Divide 27 by 10. Divide 32 by 10. Read the answers.

3. $2\frac{7}{10}$ is also written 2.7. $3\frac{2}{10}$ is also written 3.2.

4. The period between 2 and 7 in 2.7 is called the **decimal point**. The fraction $\frac{7}{10}$ may be written .7. Any fraction whose denominator is 10 may be so written. The form $\frac{7}{10}$ is the form of a **common fraction**. The form .7 is the form of a **decimal fraction**.

5. $7\frac{2}{5}$ is the quotient of $37 \div 5$. Is the divisor found in the quotient? If so, where?

6. Does the divisor appear in the quotient of $27 \div 10$? Where?

7. $3\frac{3}{5}$ is the quotient. Find the divisor, the remainder, and the dividend.

8. The following are quotients. Name the divisors, the remainders, and read the quotients: $8\frac{3}{5}$, $6\frac{7}{8}$, $5\frac{3}{10}$, 6.4, $5\frac{4}{100}$, 6.7, 50.52, 6.75, 9.38.

9. Change the following to decimals: $8\frac{3}{10}$, $9\frac{4}{10}$, $18\frac{1}{10}$, $27\frac{9}{10}$, $7\frac{8}{10}$, $1\frac{9}{10}$.

10. Read the following: 8.1, 17.5, 20.8, 9.9.

11. Write as common fractions: .6, .9, .5, .4.

12. Divide the following by 10 by placing the decimal point between the units' and tens' places in each: 93, 84, 935, 61, 80, 400, 405. Read the quotients.

346. 1. .7 is read —; .07 is read —; .007 is read seven thousandths.

2. Ten cents is what part of one dollar? Write ten cents, using the dollar sign.

3. Write one cent, using the dollar sign.

4. \$.10 is how many times \$.01? .10 is how many times .01?

5. Which is more, .8 mi., .08 mi., or .008 mi.?

6. Which is more .6 mi., .60 mi., or .600 mi.?

7. Compare: .4, .40, .400. Compare: .4, .04, .004.

8. $\frac{6}{10} = \frac{\square}{100} = \frac{\square}{1000}$. $\frac{400}{1000} = \frac{\square}{100} = \frac{\square}{10}$.

9. Express the fractions in Exercise 8 in the form of decimal fractions.

10. A **decimal fraction** is one whose denominator is 10 or some power of 10, as 100, 1000, 10,000, etc.

11. Read: .8, .67, .672. When the number of places to the right of the decimal point is one, the denominator is —; when the number of places is two, the denominator is —; when the number of places is three, the denominator is —.

12. In the decimal .7 what is the numerator? What is the denominator?

13. What is the numerator of the fraction .05? Of .324?

14. In .72 what is the numerator?

NOTATION AND NUMERATION OF DECIMALS

347. 1. The names of the orders to the right of the decimal point are:

First:	Tenths' order	.8
Second:	Hundredths' order	.67
Third:	Thousandths' order , ...	.672
Fourth:	Ten-thousandths' order . . .	.6789
Fifth:	Hundred-thousandths' order . .	.67898
Sixth:	Millionths' order	.678968

2. *Memorize the above.* Remember that four decimal places give ten-thousandths; that five decimal places give hundred-thousandths, etc.

To read a decimal, read the number without reference to the decimal point, and then add the name of the order of the right-hand figure of the numerator.

3. .62 is read sixty-two hundredths. It is given the name of the second order, hundredths.

4. .00062 is read sixty-two hundred-thousandths. Read .0062.

5. 6.72 is read six and seventy-two hundredths. Read: 24.52, 5.672, 6.08, 52.004, .52 oz., 6.5 oz.

6. Write in a column, with the decimal points directly below one another, and read: .272, .27, 7.62, 7.3, 4.67, 9.787, 6.72896.

7. Write in a column: four and sixty-two hundredths, five and sixty-five thousandths, seven and six tenths.

ADDITION OF DECIMALS

348. 1. Find the sum of 1.27, 36.2, and 54.036.

MODEL:
$$\begin{array}{r} 1.27 \\ 36.2 \\ \underline{54.036} \\ 91.506 \end{array}$$

Write the numbers so that the decimal points are directly below one another. Add as in whole numbers. Place the decimal point in the sum directly below the decimal point in the addends.

2. Add: 36.5, 42.47, 62.367, 48.

3. Add: 7.27, 52.005, 64.3, 52.

4. Add: .05, 1.0501, 10.504, 150.41, .546.

SUBTRACTION OF DECIMALS

349. 1. From 5.2 subtract 2.27.

MODEL:
$$\begin{array}{r} 5.2 \\ \underline{2.27} \\ 2.93 \end{array}$$

Consider 5.2 as 5.20. Subtract as in whole numbers. Place the decimal point in the answer directly below the decimal point in the subtrahend.

2. From 16.7 subtract 10.25.

3. From 126 subtract 8.75.

4. How much more is 35.12 than 14.6?

5. How much less is 84.7 than 125.5?

6. A man owned 127.7 A. of land. He sold 27.9 A. to one neighbor and 30.5 A. to another. How many acres had he left?

FRACTIONS CHANGED TO HUNDREDTHS

350. 1. *Memorize the following:*

$\frac{1}{2} = \frac{50}{100} = .50.$ $\frac{2}{4} = \frac{50}{100} = .50.$ $\frac{1}{25} = \frac{4}{100} = .04.$

$\frac{1}{4} = \frac{25}{100} = .25.$ $\frac{3}{4} = \frac{75}{100} = .75.$ $\frac{2}{10} = \frac{20}{100} = .20.$

$\frac{1}{5} = \frac{20}{100} = .20.$ $\frac{2}{5} = \frac{40}{100} = .40.$ $\frac{3}{10} = \frac{30}{100} = .30.$

$\frac{1}{10} = \frac{10}{100} = .10.$ $\frac{3}{5} = \frac{60}{100} = .60.$ $\frac{4}{10} = \frac{40}{100} = .40.$

$\frac{1}{20} = \frac{5}{100} = .05.$ $\frac{4}{5} = \frac{80}{100} = .80.$ $\frac{1}{50} = \frac{2}{100} = .02.$

2. Express as common fractions: .80, .75, .25, .50, .60, .40, .30, .20.

3. Express as common fractions: .05, .02, .04, .01, .10, .70, .80, .90.

4. Write with the fractional part expressed as a decimal: $6\frac{3}{4}$, $7\frac{1}{2}$, $8\frac{2}{5}$, $12\frac{1}{5}$, $25\frac{1}{20}$, $28\frac{3}{20}$, $9\frac{4}{5}$, $3\frac{3}{5}$, $14\frac{3}{4}$, $22\frac{1}{4}$.

5. Write with the decimal part expressed as a common fraction: 4.25, 6.20, 7.75, 12.80, 15.04, 35.02, 27.75, 15.60.

6. Write as decimal fractions and add: $\frac{3}{4}$, $\frac{1}{5}$, $\frac{6}{10}$, $\frac{3}{20}$, $\frac{3}{5}$, $\frac{1}{50}$.

7. Change to common fractions and reduce to lowest terms: .375, .125, .625, .875.

8. What effect upon the value of .25 has annexing a cipher to the right of it, thus: .250?

9. What effect upon the value of .25 has the placing of a cipher before it, thus: .025?

10. Express in dollars and cents: $\$6\frac{3}{4}$, $\$8\frac{1}{2}$, $\$9\frac{1}{5}$, $\$7\frac{3}{5}$, $\$10\frac{1}{10}$, $\$12\frac{1}{4}$, $\$16\frac{9}{10}$, $\$8\frac{3}{20}$, $\$7\frac{3}{50}$.

MULTIPLICATION OF DECIMALS

351. 1. Read the following: 5, .5, .05, and .005.

2. Compare the value of 5 and .5; of .5 and .05.

3. Compare: 625 ft. and 62.5 ft.; 62.5 ft. and 6.25 ft.; 6.25 ft. and .625 ft.

4. Moving the decimal point one place to the left has what effect upon the value of a number?

5. Compare: .385 ft. and 3.85 ft.; 3.85 ft. and 38.5 ft.; 38.5 ft. and 385 ft.; 385 ft. and 3850 ft.

6. Moving the decimal point one place to the right has what effect upon the value of a quantity?

7. What part of 22 is 2.2? Of 30 is 3? Of 3 is .3?

8. Multiply: 62 by 10; 36 by 10; 675 by 10.

9. Multiply: $\frac{3}{10}$ by 10; $\frac{3}{100}$ by 10; $\frac{3}{1000}$ by 10.

10. Multiply: .3 by 10; .03 by 10; .003 by 10.

11. Multiply in the shortest way possible: 2 by 10; .2 by 10; .4 by 10; 37 by 10; 3.7 by 10; .37 by 10.

12. Multiply each by 10: .67, 5.2, .52, 6.27, 7.89.

13. Compare the value of \$1.84 and \$184; of \$125 and \$1.25.

14. Multiply each by 100: \$6.25, \$.50, \$.05, \$1.05.

15. Multiply 12 by $\frac{1}{10}$. Multiply 12 by .1.

16. Divide 12 by 10. $12 \times .1 = 1.2$.

17. Multiplying a number by $\frac{1}{10}$ is the same as dividing the number by —.

352. *To multiply a decimal by an integer, multiply as in whole numbers. Point off in the answer as many decimal places as there are decimal places in the multiplicand.*

1. Multiply 42.35 by 8. MODEL:

$$\begin{array}{r} 42.35 \\ \times\ \ 8 \\ \hline 338.80 \end{array}$$

2. 63.75×5 3. 327.42×9 4. 6.843×105

353. *To multiply an integer by a decimal, multiply as in whole numbers. Point off in the answer as many decimal places as there are decimal places in the multiplier.*

1. Multiply 367 by 8.2. MODEL:

$$\begin{array}{r} 367 \\ \times\ 8.2 \\ \hline 734 \\ 2936 \\ \hline 3009.4 \end{array}$$

2. 325×8.4 3. $863 \times .94$ 4. $754 \times .380$

354. *To multiply a decimal by a decimal, multiply as in whole numbers. Point off in the answer as many decimal places as there are decimal places in both multiplier and multiplicand.*

1. Multiply 5.25 by 4.7. MODEL:

$$\begin{array}{r} 5.25 \\ \times\ 4.7 \\ \hline 3675 \\ 2100 \\ \hline 24.675 \end{array}$$

2. 6.24×4.7 3. $95.7 \times .56$ 4. $.875 \times 4.5$

355. Written Exercises.

1. 6.34×2.4	5. $.937 \times 6.3$	9. $.036 \times 4.5$
2. $83.6 \times .36$	6. $.372 \times .27$	10. $.004 \times 4.05$
3. $745 \times .67$	7. $67.5 \times .04$	11. $.405 \times .006$
4. 8.32×45	8. $9.67 \times .003$	12. $5.07 \times .001$

PERCENTAGE

356. 1. Read: $\frac{4}{100}$, .04. This may be written thus: 4%. It is then read, four per cent. **Per cent** means hundredths.

2. 5% is the same as $\frac{5}{100}$, or .05.

3. Express as per cent: $\frac{6}{100}$, $\frac{8}{100}$, $\frac{13}{100}$, $\frac{25}{100}$, $\frac{50}{100}$.

4. Express as per cent: .03, .09, .12, .40, .75, .01.

5. Express as fractions: 11%, 15%, 20%, 35%, 80%.

6. Express as decimals: 4%, 18%, 7%, 75%, 10%.

7. 6% of \$65 is the same as \$65 × .06.

8. Find 8% of \$500; of \$250; of \$1000.

9. Find 7% of \$100; of \$62.50; of \$83.75.

10. To find 10% of any number, divide the number by —.

11. Find 10% of \$250; of \$340; of \$400; of \$1000.

12. 25% is the same as $\frac{1}{4}$. To find 25% of a number, divide the number by —.

13. Find 25% of \$40; of \$800; of \$1200; of \$4.

14. 50% is the same as —. To find 50% of a number, divide the number by —.

15. Find 50% of \$80; of \$100; of \$400; of \$1000.

FRACTIONS AS PER CENTS

357. *To change a fraction to per cent, multiply the fraction by* 100. *Reduce the product to a whole or a mixed number.*

1. Change $\frac{2}{5}$ to per cent.

MODEL: $\frac{2}{5} \times 100 = \frac{200}{5} = 40$. $\frac{2}{5} = 40\%$.

Change to per cent: $\frac{1}{4}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{3}{8}$, $\frac{1}{6}$, $\frac{1}{3}$, $\frac{2}{3}$.

2. *Memorize the following:*

$\frac{1}{2} = 50\%$.	$\frac{1}{6} = 16\frac{2}{3}\%$.	$\frac{2}{3} = 66\frac{2}{3}\%$.
$\frac{1}{3} = 33\frac{1}{3}\%$.	$\frac{1}{7} = 14\frac{2}{7}\%$.	$\frac{3}{4} = 75\%$.
$\frac{1}{4} = 25\%$.	$\frac{1}{8} = 12\frac{1}{2}\%$.	$\frac{3}{8} = 37\frac{1}{2}\%$.
$\frac{1}{5} = 20\%$.	$\frac{1}{10} = 10\%$.	$\frac{5}{8} = 67\frac{1}{2}\%$.

358. Oral Exercises.

Change the per cent to a fraction and find:*

1. 25% of 200 ft.
2. 20% of \$150.
3. $33\frac{1}{3}\%$ of \$210.
4. 75% of 400 ft.
5. $66\frac{2}{3}\%$ of \$120.
6. $37\frac{1}{2}\%$ of \$80.
7. 50% of 800 mi.
8. 25% of 360 A.
9. 20% of 100 yd.
10. $14\frac{2}{7}\%$ of 70 yr.
11. $12\frac{1}{2}\%$ of \$720.
12. 10% of \$950.

13. What is 20% of \$375? 10% of \$236? 50% of \$278? 10% of 362 gal.? 25% of 640 lb.? 75% of 360 A.?

14. What is $33\frac{1}{3}\%$ of 360 A.? $62\frac{2}{3}\%$ of \$120? $14\frac{2}{7}\%$ of \$140? $16\frac{2}{3}\%$ of \$180? $37\frac{1}{2}\%$ of \$800?

* Supplement this exercise with oral drill until the pupils are able to find the above per cents readily by the use of their fractional equivalents. The fractional equivalents of the above per cents should be used in subsequent exercises.

359. Written Exercises.

1. Merchandise is generally sold at a certain per cent profit on the cost. What per cent of profit do you think a grocer should make on tea? * On sugar? On strawberries?

2. If a grocer buys tea at 30¢ a pound, and sells it at a profit of $33\frac{1}{3}\%$, what is the selling price per pound?

3. A merchant bought a suit for $15 and sold it at a profit of 20%. What was his profit?

4. Locate Ogden, Omaha, and San Francisco on the map. It is 844.7 mi. from Ogden to San Francisco, and 1004.7 mi. from Ogden to Omaha. How far is it from San Francisco to Omaha? How much nearer is Ogden to San Francisco than to Omaha?

5. A merchant bought cloth at $.12 a yard, and sold it at a gain of 25%. What was his profit on each yard? What was the selling price per yard?

6. A clothing store advertised boys' suits worth $12 at 25% reduction. Find the amount of the reduction and the cost of a suit.

7. A dry goods store advertised a 20% reduction sale on carpets. Find the reduction per yard on carpets that formerly sold at 60¢ a yard.

8. A dealer in farm implements bought carriages at $50 and sold them at a profit of 20%. Find his profit on each carriage sold.

* Discuss these and similar questions with class.

INTEREST

360. 1. When one rents a house from another, how does he usually pay for its use?

2. When one rents a farm from another, how does he usually pay for its use?

3. When one borrows money from another, how does he usually pay for its use? What is the name given to money paid for the use of money?

4. What is the meaning of the following: "Money to loan on good securities. Interest 5%."?

5. A man borrowed $600 for one year. He paid $.05 for the use of each dollar, or 5% of the amount borrowed. How much **interest** did he pay?

6. A boy borrowed $40 from his father to buy a bicycle. He agreed to pay his father 5% interest. How much interest should he pay each year?

7. A contractor borrowed $3000 at 6% and used the money to build a house, which he rented at $20 a month. Find the interest which he must pay each year. Find the amount of rent which he receives each year. How much more does the rent amount to than the interest?

8. Find the interest on $1800 for 1 year at 6%.

9. Find the interest on $2000 for 1 year at 8%.

10. Find the interest on $2000 for 2 years at 8%.

11. Find the interest on $6500 for 1 year at $6\frac{1}{2}$%.

The money borrowed or loaned is called the **principal.**

DIVISION OF DECIMALS

361. Oral Exercises.

1. 4 pt. ÷ 2 pt. = —. 8 qt. ÷ 2 qt. = —.

2. 16 gal. ÷ 2 gal. = —. 10 mi. ÷ 2 mi. = —.

3. 8 tenths ÷ 2 tenths = —. 4 hundredths ÷ 2 hundredths = —.

4. .9 ÷ .2 = —. .04 ÷ .02 = —.

5. .12 ÷ .06 = —. .8 ÷ .4 = —.

6. .008 ÷ .002 = —. .044 ÷ .004 = —.

7. If the divisor contains tenths, tenths of the dividend may give a whole number in the quotient. 1.6 ft. ÷ .2 ft. = 8.

8. If the divisor contains hundredths, hundredths of the dividend may give a whole number in the quotient. .16 ft. ÷ .02 ft. = 8.

362. Written Exercises.

1. Divide 12.2 by .2.

MODEL: $.2\overline{)12.2}$ $\quad 61.$

Note first the lowest order in the divisor. In this case tenths is the lowest order in the divisor. Place the decimal point above and after the figure of the dividend occupying tenths' place. Divide without reference to the decimal point in the quotient.

Place the decimal point in the quotient above and after the figure in the dividend occupying the same order or place as the lowest order in the divisor.

2. Divide .66 by .02; .328 by .04.

MODEL: $.02\overline{).66}$ MODEL: $.04\overline{).328}$

3. Divide 6.6 by .03.

$$.03\overline{)6.60}\quad 220.$$

MODEL: As the divisor contains hundredths, change the dividend to hundredths by annexing a cipher. Place the decimal point above and after hundredths' place. Why?

4. Divide 12 by .002.

MODEL: $.002\overline{)12.000}$

5. Divide .126 by 2.

$$2.\overline{).126}\quad .063$$

MODEL: As units' order is the lowest order in the divisor, place the decimal point above and after the units' place of the dividend. 2 is contained in 1 no times. Write 0 in the quotient. Complete the division.

363. Arrange as in the models and fix the decimal point in the quotient:

	a	*b*	*c*	*d*
1.	$1.26 \div 4$	$.36 \div .02$	$3.6 \div 2$	$360 \div .002$
2.	$.52 \div .2$	$72.8 \div 6$	$7.2 \div 2$	$360 \div 7.5$
3.	$1.55 \div 5$	$20.65 \div 5$	$15.5 \div .05$	$4.2 \div 32.62$
4.	$1.6 \div 2$	$16 \div .002$	$.16 \div 20$	$.678 \div 629$
5.	$2.4 \div 6$	$.240 \div .006$	$2.40 \div 12$	$.54 \div .0008$

364. Written Exercises.

Arrange as in the models and fix the decimal point before dividing:

1. Divide 12 by .02; 82 by .04; 5.2 by .02.
2. Divide 3.6 by .2; 7.2 by .2; .72 by .02.
3. Divide 13.6 by .02; 6.66 by .002.
4. Divide .155 by 5; .2065 by 5.
5. Divide each by .002: 1.6, 16, .16, .0016.
6. Divide each by 5: 1.5, .015, .15, .0015.
7. Divide each by .05: .35, 3.5, .035, .0035.
8. Divide each by .025: 62.5, 625, 6.25, .0625.
9. Divide each in No. 8 by 2.5; by 250.
10. Divide each by 9.3: 23.25, 4.65, 465, .0465.
11. Divide each by \$.96: \$240, \$2.40, \$.48.
12. Divide \$170 by \$.85; 138 by 95; 625 by .25.
13. At \$.96 each, how many books can be bought for \$2.40? For \$24? For \$4.80? For \$48?

365. Oral Exercises.

1. Find 6% of \$350. Find $8\frac{1}{2}$% of \$250.
2. Find $7\frac{1}{2}$% of \$360. Find $9\frac{1}{3}$% of \$360.
3. Find 3% of \$60; of \$27; of \$35; of \$3.50.
4. Find $2\frac{1}{2}$% of \$12; of \$20; of \$30; of \$24.
5. Find 8% of \$60; of \$90; of \$75; of \$62.
6. 3% of my money is \$9. Find 1% of my money.
7. 1% of my money is \$3. Find 100% of my money.

366. Oral Exercises.

1. 7 is $\frac{1}{2}$ of 14. 7 is —% of 14.

2. 6 is — third of 18. 6 is — % of 18.

3. 5 is — third of 15. 5 is — % of 15.

4. 7 is — third of 21. 7 is — % of 21.

5. 1 pt. is — half of 1 quart. 1 pt. is — % of 1 quart.

6. 1 qt. is — fourth of 1 gal. 1 qt. is — % of 1 gal.

7. 1 ft. is — third of 1 yd. 1 ft. is — % of 1 yd.

8. 3 in. are — fourth of 12 in. 3 in. are — % of 12 in.

9. 6 in. are — — of 12 in. 6 in. are — % of 12 in.

10. 2 pt. are — — of 1 gal. 2 pt. are — % of 1 gal.

11. 5 men are — — of 15 men. 5 men are — % of 15 men.

12. 6 men are $\frac{1}{3}$ of — men. 6 men are $33\frac{1}{3}$% of — men.

13. 12 men are $\frac{2}{5}$ of — men. 12 men are 40% of — men.

14. \$5 is $\frac{1}{5}$ of \$—. \$5 is 20% of \$—.

15. 16 men are $\frac{1}{2}$ of — men. 16 men are 50% of — men.

16. A boy sold an article for $\frac{3}{2}$ of its cost. He gained what part of the cost? He gained 5 cents. Find the cost.

17. 5% of my money is \$25. Find 1% of my money. Find 100% of my money.

367. Written Exercises.

1. Divide 4.628 by 89.

MODEL:
$$\begin{array}{r} .052 \\ 89)\overline{4.628} \\ 4\,45 \\ \hline 178 \\ 178 \\ \hline \end{array}$$

Place the decimal point in the quotient above and after the order in the dividend that corresponds to the lowest order in the divisor, — in this case, units. 89 is contained in 4 no times. This shows that there is no whole number in the quotient. Do not write the 0 in the quotient. 89 is contained in 46 no times. Write the 0 in tenths' place in the quotient. 462 will contain 89. Complete the division.

2. Divide each by 87: 20.01, 391.5, 7.743, 2.2815.

3. Divide each by 7.9: 1.6195, 24.174, .32232, 481.11.

4. Divide each by 5.23: 42.886, .8368, 2615.

5. A boy paid $.12 for 6 oranges. Find the cost of 1 orange.

6. A boy paid $.06 for 12 apples. Find the cost of 1 apple.

7. A farmer sold 220 boxes of apples for $121. Find the selling price per box.

8. Find what per cent 8 is of 16; 12 is of 48; 9 is of 72; 64 is of 128.

9. Find what per cent 45 is of 50; 40 is of 50; 30 is of 20.

368. *To multiply a number by* 25, $33\frac{1}{3}$, $66\frac{2}{3}$, 50, *etc., multiply the number by* 100 *and take such a part of the product as the multiplier is of* 100.

1. Multiply 624 by 25.

MODEL: 15600 — 25 is $\frac{1}{4}$ of 100. Multiply 624 by 100, and take $\frac{1}{4}$ of the product.
4)62400

2. Multiply: 78 by $66\frac{2}{3}$; 69 by $33\frac{1}{3}$; 240 by $37\frac{1}{2}$; 240 by $62\frac{1}{2}$; 480 by 75.

3. Multiply: 360 by 25; 1876 by 75; 1728 by $12\frac{1}{2}$; 5280 by $33\frac{1}{3}$; 144 by 50.

369. *To divide a number by* 25, $33\frac{1}{3}$, $37\frac{1}{2}$, $66\frac{2}{3}$, 75, *etc., divide the number by* 100 *and multiply the result by the inverted form of the fraction that indicates the part the multiplier is of* 100.

1. Divide 1440 by $66\frac{2}{3}$.

MODEL: 14.40 — $66\frac{2}{3}$ is $\frac{2}{3}$ of 100. Divide 1440 by 100, and multiply the quotient by $\frac{3}{2}$.
· 3
2)43.20
21.60

2. Divide: 982 by $33\frac{1}{3}$; by 75; by $66\frac{2}{3}$; by $62\frac{1}{2}$; by $37\frac{1}{2}$.

3. Divide: 1728 by 75; 5280 by $37\frac{1}{2}$; 5760 by $33\frac{1}{3}$; 640 by $12\frac{1}{2}$; 6335 by $14\frac{2}{7}$.

370. *To divide a number by* 200, 300, 2000, *etc., point off as many places from the right as there are ciphers in the divisor, and divide by the left-hand figure of the divisor.*

1. Divide 627 by 200.

MODEL: $\begin{array}{r} 3.135 \\ 2)\overline{6.27} \end{array}$ Point off two places. Divide 6.27 by 2.

2. Divide 768 by 3000.

MODEL: $\begin{array}{r} .256 \\ 3)\overline{.768} \end{array}$ Point off three places. Divide .768 by 3.

3. Divide: 5758 by 2000; 8520 by 2000; 68,960 by 5000.

371. *To find* 25%, $33\frac{1}{3}\%$, $66\frac{2}{3}\%$, *etc., of a number, take such a part of the number as the required per cent is of* 100%.

1. Find $33\frac{1}{3}\%$ of \$7521.

MODEL: $\begin{array}{r} \$2507 \\ 3)\overline{\$7521} \end{array}$ $33\frac{1}{3}\%$ is $\frac{1}{3}$ of 100%. Take $\frac{1}{3}$ of \$7521.

2. Find $37\frac{1}{2}\%$ of \$88; $33\frac{1}{3}\%$ of 66; $62\frac{1}{2}\%$ of \$64; 75% of \$160; $87\frac{1}{2}\%$ of \$64.

3. A man bought a farm for \$1200. He sold it at a profit of $33\frac{1}{3}\%$. What was his gain? What was his selling price?

4. \$12 is $\frac{4}{5}$ of what number? \$12 is $33\frac{1}{3}\%$ more than what number?

CHAPTER VI

DENOMINATE NUMBERS

372. Denominate units of measure have been established in accordance with law, or custom, to measure values, weight, time, length, surface, capacity, etc.

UNITED STATES MONEY

10 mills (m.) = 1 cent (¢)
10 cents = 1 dime (d.)
10 dimes = 1 dollar ($)
10 dollars = 1 eagle (E.)

How many dollars are there in a double eagle?

Beginning with the one of least value, name the coins that are in circulation.

Beginning with the one of least value, name the bills that are in circulation.

373. PAPER MEASURE

24 sheets = 1 quire
20 quires = 1 ream
2 reams = 1 bundle
5 bundles = 1 bale

How many sheets of paper are there in $\frac{1}{4}$ quire? In 2 quires? In $\frac{1}{2}$ quire?

374. COUNTING

12 units = 1 dozen (doz.)
12 dozen = 1 gross
12 gross = 1 great gross
20 units = 1 score

Name something that is sold by the gross.

375. TIME MEASURE

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
52 weeks = 1 year (yr.)
365 days = 1 year
366 days = 1 leap year
100 years = 1 century.

A centennial year is one whose number is divisible by 100. Centennial years whose numbers are divisible by 400, and other years whose numbers are divisible by 4, are leap years.

376. LIQUID MEASURE

4 gills = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)
$31\frac{1}{2}$ gallons = 1 barrel (bbl.)
2 barrels = 1 hogshead (hhd.)

377. Written Problems.

1. Find the number of years, months, and days from January 3, 1873, to November 1, 1904.

MODEL: 1904 yr. 11 mo. 1 da. November 1,
1873 yr. 1 mo. 3 da. 1904, is the first
31 yr. 9 mo. 28 da. day of the eleventh month in the year 1904. January 3, 1873, is the third day of the first month in the year 1873. Write these dates as above, and subtract. 3 da. cannot be taken from 1 da., so add 30 da. (one month) to 1 da. Subtract 3 da. from 31 da. As one month was added to the minuend, add one month to the subtrahend. This changes 1 mo. to 2 mo. Subtract 2 mo. from 11 mo. Then subtract 1873 yr. from 1904 yr. The answer is 31 yr., 9 mo., and 28 da.

2. Abraham Lincoln was born February 12, 1809. He died April 15, 1865. How old was he when he died?

3. George Washington died December 14, 1799. How many years is it since his death?

4. Daniel Webster died October 24, 1852, at the age of 70 yr. 9 mo. 6 da. What was the date of his birth?

5. William Penn was born October 14, 1644. He died at the age of 73 yr. 9 mo. 16 da. What was the date of his death?

6. A man borrowed money January 16, 1902. He paid it March 7, 1903. How long did he keep the money?

378. AVOIRDUPOIS WEIGHT

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (cwt.)
2000 pounds = 1 ton (T.)

The long ton contains 2240 pounds. It is used at the custom-houses in invoices of some imports, and sometimes in weighing coal.

379. Oral Exercises.

1. Hold up enough books to weigh about one pound.

2. An ounce is what part of a pound?

3. How many hundredweight are there in 600 lb.? In 624 lb.? In 52 lb.? In 167 lb.?

4. How many pounds are there in $\frac{1}{4}$ cwt.? In $2\frac{1}{2}$ cwt.? In $3\frac{3}{4}$ cwt.? In 1 T.? In 1 T. and 2 cwt.?

380. Written Exercises.

1. A bushel of wheat weighs 60 lb. How many bushels of wheat will weigh 1 T.? $3\frac{1}{2}$ T.? 5.4 T.?

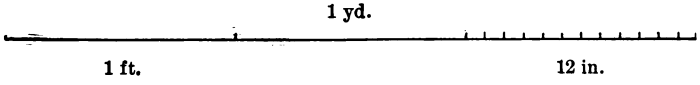
2. When wheat is worth \$.80 a bushel, how much is 1 T. worth?

3. When wheat is selling at \$1.75 per hundredweight, what is the price per bushel?

4. A farmer sold his wheat at \$18 a ton. He had 63,896 lb. of wheat. How much did he receive for his crop?

5. What per cent of a pound is 8 ounces?

MEASURE OF LENGTH



381. 1. One foot is what part of 1 yd.?

2. One inch is what part of 1 ft.? It is what per cent of 1 ft.?

3. What part of 1 ft. are 4 in.? 6 in.? 9 in.? 8 in.? 2 in.? 3 in.?

4. What per cent of 1 ft. are 4 in.? 6 in.? 9 in.? 8 in.? 2 in.? 3 in.? 12 in.?

5. A fathom (6 ft.) is used to measure the depth of the sea.

6. A chain (4 rd.) is used by surveyors in measuring land.

7. A hand (4 in.) is used in measuring the height of a horse.

8. A horse is 15 hands high. How many feet high is the horse?

SQUARE MEASURE

382. See p. 175.

1. Find the number of square feet and the number of square yards in a surface 36 ft. long and 24 ft. wide.

2. How many square feet are there in the floor of your schoolroom?

3. Find the number of square yards of plastering there are in your schoolroom.

CUBIC MEASURE

383. 1. A cubic inch is a solid whose six equal sides are each 1 sq. in.

2. A cubic foot is a solid whose six equal sides are each 1 sq. ft.

3. Examine the cubic inch. Has it length? Has it width? Has it thickness?

4. How many cubic inches will cover a square foot of surface? Try it.

5. If you make them 2 deep, how many cubic inches can you place on a square foot of surface? 3 deep? 12 deep? The pile 12 deep will be a cubic foot.

7. There are — cubic inches in a cubic foot.

8. Think of a box 8 in. long, 4 in. wide, and 3 in. high. How many cubic inches could be placed on the bottom of the box? How many deep could you place the blocks before the box would be full?

MODEL:

8 cu. in. = the number of cubic inches that can be placed in a space 8 in. long, 1 in. wide, and 1 in. high.

32 cu. in. = the number of cubic inches that can be placed in a space 8 in. long, 4 in. wide, and 1 in. high.

96 cu. in. = the number of cubic inches in a space 8 in. long, 4 in. wide, and 3 in. high.

384. 1. *Memorize the following:*

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)
128 cubic feet = 1 cord of wood

2. Draw a cubic inch. Draw a cubic foot.

3. How can you find how many cubic inches there are in 2 cu. ft.?

4. How many cubic inches are there in 3 cu. ft.? In 3 cu. ft. and 120 cu. in.?

5. A man dug a cellar 18 ft. long, 12 ft. wide, and 6 ft. deep. How many cubic feet of earth did he remove? How many cubic yards did he remove? He was paid $.32 a cubic yard. How much did he receive for the work?

6. A trench was dug 3 ft. 6 in. ($3\frac{1}{2}$ ft.) wide and 12 ft. deep, in which to lay a sewer. The sewer was 1 mile (5,280 ft.) long. How many cubic yards of earth were removed?

7. Find the number of cubic feet in a space 12 ft. long, 8 ft. wide, and 6 ft. deep.

8. Find the number of cubic feet in your schoolroom.

9. A box contains 60 cu. ft. It is 5 ft. long and 4 ft. high. How wide is it?

10. A room contains 1620 cu. ft. It is 15 ft. long and 12 ft. wide. How high is it?

LUMBER MEASURE

385. Lumber is measured by the board foot.

A **board foot** is a piece of lumber one foot long, one foot wide, and one inch thick.

To find the number of board feet in a piece of lumber, multiply the length of the piece in feet by the thickness of the piece in inches, and this by the width of the piece in inches, and divide the product by 12.

To shorten the work use cancellation.

1. Find the number of feet of lumber in a piece of lumber 16 ft. long, 9 in. wide, and 3 in. thick.

MODEL: $\dfrac{\overset{4}{\cancel{16}} \times 9 \times \overset{}{\cancel{3}}}{\underset{}{\cancel{12}}_{\cancel{3}}} = 36$, the number of board feet.

2. Find the number of feet of lumber in 12 pieces, each 16 ft. long, 8 in. wide, and 1 in. thick.

3. Find the number of board feet in a timber 20 ft. long, 8 in. wide, and 8 in. thick.

4. Find the number of board feet of flooring in the floor of your schoolroom.

5. At $ 12 per thousand feet, what will be the cost of 20 pieces, each 10 ft. long, 4 in. wide, and 2 in. thick?

6. Find the cost of lumber at a neighboring lumber yard.

CASH ACCOUNT

386. A **cash account** is a written statement of cash received and cash paid out.

Dr.	Received cash.				Paid out.				*Cr.*	
1905					1905					
Jan.	1	On hand	8	75	Jan.	2	By cash		4	00
"	8	To salary	12	00	"	13	" board		7	00
"	16	To remit	30	00	"	16	" bank deposit		30	00
"	24	To salary	12	00	"	25	Balance		21	75
			62	75					62	75
Jan.	25	On hand	21	75						

387. 1. The left-hand side, or debit side, of a cash account shows the cash received and from what sources it was received.

2. What does the right-hand, or credit side, of a cash account show?

3. Why should one keep a cash account?

4. What is meant by the entry "On hand $8.75"?

5. The above was Mr. A's cash account from January 1 to January 25, 1905. How much cash did Mr. A receive during this time?

6. With the $8.75, how much cash must be accounted for?

7. What did Mr. A do with his money?

8. How much money had Mr. A on hand Jan. 25?

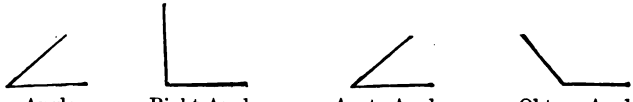
9. What is meant by "Balance"?

10. This was Harry's cash business for the month of February, 1904. Rule your paper, make up, and close Harry's account. Feb. 1 Harry had on hand $.45; Feb. 2 he paid out for papers $.35, and received for papers $.70; Feb. 3 he received for weeding a garden ("for labor") $.60; Feb. 4 he paid for papers $.60, and received for papers $1.20; Feb. 8 he paid $.10 carfare, and received for delivering a package $.35; Feb. 9 he bought a book for his sister, paying $.20; Feb. 12 he earned $1, and spent for carfare $.20.

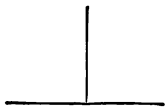
11. Make similar accounts.

ANGLES

388. An **angle** is the opening between two lines that meet.



1. Join two lines at a point not at the ends of the lines. How many right angles is it possible to make with two lines thus joined? How many obtuse angles? How many acute angles?



2. A **right angle** is an angle formed by the meeting of one straight line **perpendicular** to another.

3. An **acute angle** is an angle that is less than a right angle.

4. An **obtuse angle** is an angle that is greater than a right angle.

5. How many angles has a square? An oblong? What kind of angles are they?

6. Draw a circle on the blackboard. Divide it into fourths. How many right angles are there in the circle?

7. In the figures on page 64, which angles are right angles?

8. The line that bounds a circle is called its **circumference.**

9. Angles are measured in degrees. The angles of a circle are measured on its circumference. There are 360 degrees in a circle.

10. How many degrees are there in a right angle? In one half of a right angle?

11. Divide a right angle into three equal angles. How many degrees are there in each of these angles?

12. An angle of 180 degrees is equal to two right angles. Explain why there are 180 degrees from the north pole to the south pole.

13. Explain the use of meridians and parallels.

389. CIRCULAR MEASURE

60 seconds (″) = 1 minute (′)
60 minutes = 1 degree (°)
360 degrees = 1 circle

390. **ROMAN NOTATION**

1	I	10	X	100	C	1000	M
2	II	20	XX	200	CC	2000	MM
3	III	30	XXX	300	CCC	3000	MMM
4	IV	40	XL	400	CD	4000	$\overline{\text{IV}}$
5	V	50	L	500	D	5000	$\overline{\text{V}}$
6	VI	60	LX	600	DC	6000	$\overline{\text{VI}}$
7	VII	70	LXX	700	DCC	7000	$\overline{\text{VII}}$
8	VIII	80	LXXX	800	DCCC	8000	$\overline{\text{VIII}}$
9	IX	90	XC	900	CM	9000	$\overline{\text{IX}}$

391. 1. The letters used in Roman notation are: I, V, X, L, C, D, M.

2. When a letter of less value is written before a letter of greater value, its value is taken from that of the letter of greater value; as, IV, IX, XL. When it is placed after a letter of greater value, it is added; as, VI, XI, LV, etc.

3. A dash placed over a letter or a combination of letters increases the value a thousand-fold.

4. Write in Roman notation: 27, 34, 68, 89, 235, 309, 540, 894, 1000.

5. Write in Roman notation: 1890, 1776, 1904, 2000.

6. Write in figures:

CDXXI MXCIV MDCCCXCIX

7. Where have you seen the Roman numerals used?

АБ